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PRIVATE RETURNS TO TEACHER EDUCATION
IN ALBERTA



BY
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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled "Private Returns to Teacher Education in Alberta" submitted by Dennis John Dibski in partial fulfilment of the requirements for the degree of Doctor of Philosophy.

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ABSTRACT

The central purpose of the study was to make an investment analysis of private monetary returns to successively higher increments of teacher education for different types of subjects in Alberta. Human capital provided the conceptual framework for the study, and cash flow analysis the specific techniques that were employed.

The subjects of the study consisted of members or potential members of the Alberta teacher labour force who qualified to attend university to acquire initial or additional teacher education up to the Bachelor of Education degree level. University attendance was treated as an investment in human capital that could be analysed as to profitability by examining the relationship between the cost flows and the increased future earnings that would result from taking teacher training. To capture the effects of factors such as sex, age, experience, teacher education held, and teacher education sought on returns, the subjects were classified into fifty different types. The investment problems associated with each subject type were analysed by the calculation of present values and internal rates of return. These computations were interpreted in terms of a given minimum return that had to be shown by the educational investment in order for it to be considered profitable.

The analysis disclosed that for high school graduates

a three- or four-year program of teacher education was financially attractive for Alberta males under age twenty-five, but not for males over this age. In contrast, the same investments proved to be highly profitable for females at any age level up to age fifty-five. Additional teacher education taken by subjects who already held some training was shown to be profitable under all of the conditions studied, provided that it was followed by from ten to fifteen years of teaching. The degree of profitability varied directly as years of training and experience held at commencement of further study, years of additional teacher education sought, and length of teaching service following the period of study. Obtaining a Bachelor of Education degree or its equivalent proved to be the most attractive investment choice financially.

Comparisons with other studies showed that private returns to a teaching degree for Alberta males were equal to returns averaged by all degreed male teachers in Canada, but were less than returns reported for Canadian males with a university degree. Alberta female graduates in teacher education earned higher private returns than were earned by Canadian male or female teachers or by male university graduates in Canada.

Various implications of the findings for decision-making at the individual and social levels were noted. Particular reference was made to problems of teacher supply and teacher quality, certification, rates of salary, academic costs, efficient allocation of resources in education, and the free operation of the teacher labour market.

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CHAPTER I

DESCRIPTION OF THE PROBLEM

When any expensive machine is erected, the extraordinary work to be performed by it before it is worn out, it must be expected, will replace the capital laid out upon it, with at least the ordinary profits. A man educated at the expense of much labour and time to any of those employments which require extraordinary dexterity and skill, may be compared to one of those expensive machines. The work which he learns to perform, it must be expected, over and above the usual wages of common labour, will replace to him the whole expense of his education, with at least the ordinary profits of an equally valuable capital. It must do this too, in a reasonable time, regard being had to the very uncertain duration of human life, in the same manner as to the more certain duration of the machine (Adam Smith, quoted in Renshaw, 1960, p. 318).

As early as 1776, Adam Smith stated in his principle work, *The Wealth of Nations*, that the education and training of workers may be viewed as capital investment in the same way as are financial outlays on the physical factors of production. Through education and training, man acquires the knowledge and the skills required for the performance of the more complex tasks associated with industrial and social development. This knowledge and these skills, in as far as they enable firms to maintain and to increase the value of their productivity, become marketable, sought-after commodities. The market provides higher rewards for higher skill training to the degree that this human resource is essential to production. Thus, according to Bertram (1966,

p. 46), one may expect and indeed does find that there is a close relationship between a person's education and his earnings. Bertram (1966, p. 2) also writes that in the aggregate educated man's greater productivity contributes to the growth of the national income, and for this reason, the educational stock of a nation has become recognized as a significant determinant of its economic prosperity and growth. This capital view of man, which holds that labour's productive capacity is enhanced through education, stems from an important concept in the field of economics known as *human capital*.

The contribution of education to personal income and to national economic growth has in recent years become an object of increasing empirical research and scholarly inquiry. Most of the activity has occurred in the United States, but studies have also appeared in European, Asian, and South American countries. International organizations as well -- such as the United Nations and the Organization for Economic Cooperation and Development, for example -- are giving considerable attention to the role of human capital formation in the social and economic progress of nations. Bowman (1966, p. 113) comments that human capital is an old concept that has resurfaced "as something of a revolution" in modern economic thought.

The human capital orientation to education is concerned primarily with the relations between resources

utilized to form human competencies (the resource costs of education) and the increments to productivity which result. One of the specific techniques employed in the analysis of this relationship is known in the mathematics of finance as *cash flow analysis*. When this method is applied to private investment in education, it involves three essential steps. First, the costs of providing a certain amount of education to an individual is measured. Secondly, an estimate is made of the benefits which will accrue over time from the educational investment. Thirdly, the profitability of the investment is analysed by converting net future benefits to their present value, and by finding the internal rate of return. When the investment analysis is concerned only with costs and benefits as they apply to the individual, the results are referred to as *private returns*. If the analysis takes into account total resource costs and the value of both private and social benefits, then the analysis is in terms of *social returns*.

Cash flow analysis was developed for use in business and industry to provide a method for rationally evaluating proposed capital investments. In this domain, it serves as a basis for making economically sound decisions with respect to how a firm's limited productive resources may be utilized most profitably. When the methodology is adapted and applied to an analysis of education as investment in human capital, it serves the same purpose. It leads to an

understanding of the economic relationship between educational costs and benefits, and this knowledge serves as essential information for individual or social decisions.

This brief introduction to the concepts of human capital and cash flow analysis is intended to serve as a preface for the following discussion relating to the purpose and problem of the study. The concepts are examined in greater depth in later chapters. The essential point to be made now is that human capital provided the theoretical perspective for this investigation and some selected techniques of cash flow analysis the methodology that was employed.

General Nature of the Study

The major objective of the study was to make an investment analysis of private economic returns to teacher education in the province of Alberta that could serve as the basis for rational choice for any teacher decision-maker who is faced with the option of whether or not to acquire additional full years of professional teacher education leading to a Bachelor of Education degree. Before elaborating any further on this objective, it is necessary to define the "teacher decision-makers" that were the subjects of the study.

To begin with, the subjects were thought of as falling into two broad categories: (1) high school graduates who were

contemplating teaching as a possible career choice and who had no years of teacher training, and (2) persons with teaching certificates who possessed partial completion of the Alberta four-year Bachelor of Education degree. For this study, partial completion of the degree meant holding credit for one, two, or three full years of teacher education. The certificated person did not necessarily have to be teaching to be considered a subject for the study. These two categories were collapsed into one and their members referred to simply as the "subjects" of the study. Thus, to reiterate and to give an operational definition, the "subjects" were any potential or current members of the Alberta teacher labour force who faced the decision of whether or not to attend a university in Alberta for the purpose of acquiring some years of professional teacher education up to and including the Bachelor of Education degree. It was assumed that having completed this training the subjects would enter into teaching.

From an economic point of view a subject's decision to go into teaching or to improve his teacher qualifications through additional training hinges very much upon his knowing what the costs and returns of such a move would be. In addition, he must be able to relate cost and return data in such a way that the results are meaningful *per se* and comparable when alternative choices are considered. The cash flow analysis used in the study provides a method for

relating costs and benefits in such a way that the profitability of an investment in teacher education may be determined. The analysis requires the derivation of three major kinds of mathematical data: (1) net cash flow, (2) present value, and (3) internal rate of return. Basic to the calculation of each of these are the estimates of the costs and the earnings that accompany the investment venture.

A detailed explanation of the mathematics involved in the analysis is reserved for later. However, enough of an explanation of the method is required now to give clarity to the statement of the research problem. Accordingly, the following two sections are devoted to background which will facilitate stating the problem. In the first section, an introduction to cash flow analysis is given. The references upon which this introduction is based are Cissell & Cissell (1969, Chaps. I, II, VII), and Edge (1965). In the second section, the variables relating to the problem are identified.

Cash Flow Analysis

Cash flow analysis is a general and powerful technique for analysing investment problems prior to making a decision. It takes into account not only the size of the cash flows but their timing as well, and provides a prediction of whether or not the investment will be profitable.

The acquisition of a capital asset usually involves an

immediate outlay of funds, followed by a stream of costs and earnings over time. The immediate outlay and subsequent costs and earnings are called cash *outflows* and *inflows*. When cash outflows and inflows are combined into a single stream (inflows minus outflows) the result is referred to as the *net cash flow*.

Cash flows tend to occur continuously rather than at stated time periods. A retail business, for example, has money coming in every day that the business is open, and it also has outflows in the form of expenses. However, making practical decisions based on cash flows is simplified if the flows are assumed to be concentrated at the end of a period, say, at the end of a month, or at the end of a year. The convention of placing all flows at the end of a period was adopted for this study. Each period was considered to be one year in length.

The timing of the cash flows is important in an investment analysis because money has a time value. When an invested sum is considered in terms of future value, it grows larger because of interest accumulation. When a sum due in the future is valued in terms of what it is worth now, it is discounted and becomes smaller. To illustrate, a dollar received now is worth more than a dollar to be received a year from now because of the interest that can be earned in a year's time. Similarly, if a debt of one dollar due in one year is retired by a cash payment now, the debtor

can properly discount the debt to the present time by the amount of interest the dollar could earn in a year. The rate of discount that is used is determined by the interest rates prevalent on the market at the time.

The time value of money is of fundamental importance in handling cash flows, because funds expended or received over some future intervals of time cannot be compared, or added, or subtracted, etc., until they have been valued at some common point in time. In investment analysis the common point in time, or the *focal date*, is the point at which the decision is to be made to commit resources to the formation of capital. In most cases, the time is taken as the present.

There are several ways in which cash flows resulting from capital investment can be analysed, having regard to the time value of money. Only two techniques are pertinent to this study. One is to discount all cash flows to the present using a given rate or using several rates. The algebraic sum of the discounted cash flows is called the *net present value*, or simply the *present value*, of the investment.¹ If the present value is positive at an acceptable yield rate, the investment is a profitable one. Also in comparing alternative investment possibilities, one

¹The present value is sometimes called the *discounted cash flow* (D.C.F., for short), *capitalized value*, or *present discounted value*.

investment is more profitable than the other if its present value is higher. The second method is to solve what is referred to as the *equation of value* to find the *internal rate of return*.² The equation is simply one which sets the value of the sums of outflows as equal to the value of the inflows at the focal date. The yield rate which makes these two flows equal is the internal rate of return. Alternatively, the internal rate of return may be defined as that rate of discount which makes the present value of the net cash flow equal to zero. It indicates the rate of interest an investor earns on his investment if he recovers his capital in a stipulated number of time periods.

Cash flow valuation provides a useful conceptual tool for making a pre-decision analysis of a proposed investment in further education. The subjects of this study were thought of as facing such as investment problem. Its resolution involves using estimates of costs and returns over the length of the earning period to calculate: (1) the net cash flow that accrues to the subject as a result of his investing in teacher education (in this study, the net cash flow was called the *net earnings stream*, or the *marginal earnings stream*), (2) the present value of the net cash flow at selected rates of interest, and (3) the internal rate of

²Internal rate of return has many synonyms: the *D.C.F. rate of return*, the *profit rate*, the *marginal efficiency of investment*, and *payback* are examples.

return. These calculations would enable the subject to predict whether taking additional teacher training pays off in terms of what he personally considers to be a good return on investment. Also, he has the data to choose between the alternate routes open to him. Should he, for example, take one, two, or three additional years of training? Should he finish his degree? Which choice yields the highest return? If he goes to university, how long a period of teaching service is needed to recover his investment? The intention of a cash flow analysis of returns to teacher education is to provide answers to questions such as these.

The results of the analysis may indicate to the subject that he should choose not to invest in teacher education either because the move is not profitable or because higher returns may be gained by investing the capital funds in some other way. The money could be used for business investment, for buying stocks and bonds, or for training for some other type of career or profession. If the subject's intention is to make a rational decision in a financial sense, he will not voluntarily choose additional teacher education unless the extra years of training promise a return equal to or greater than the return possible from some alternative investment opportunity.

The results of investment analysis, therefore, should influence the decision-making process of subjects who are contemplating initial or additional teacher education.

However, the results may also have important implications for educational decisions made at the social policy level. This aspect of the problem will be explored later.

The Variables in the Study

Six subject-related variables were basic to the problem of the study; they are enumerated and described as follows:

1. The number of full years of undergraduate teacher education presently held and recognized for salary purposes.
2. The number of years of teacher education being contemplated.
3. The number of years of past teaching experience or of age that is recognized for salary purposes. (Years of age are applicable only to high school graduates who have no teacher training. For them, age not years of teaching experience is a determinant of salary level.)
4. The number of years of teaching service expected after completion of the initial or additional years of teacher education; or, in other words, the length of the payoff period.
5. The expected average costs of the teacher training, including opportunity costs (i.e., earnings stream foregone), over the length of the earnings stream.
6. The expected average salaries receivable for each period over the length of the earnings stream.

The first three variables listed above were used to form a typology of subjects. The latter three determined the nature of the marginal earnings stream for each type of subject.

Statement of the Problem

The research problem central to the study was stated as follows:

WITHIN THE PROVINCE OF ALBERTA, WHAT ARE THE PRESENT VALUES OF AND THE INTERNAL RATES OF RETURN ON THE MARGINAL EARNINGS STREAMS THAT ARE EXPECTED TO RESULT FROM INVESTMENT BY DIFFERENT TYPES OF SUBJECTS IN GIVEN YEARS OF UNDERGRADUATE TEACHER EDUCATION?

The problem was broken down into the following sub-problems which are listed in the order in which the investment analysis was made:

1. What are the estimated private costs of and private returns to the investment in given years of teacher education by different types of subjects?

2. What resultant net cash flows or marginal earnings streams may be expected for different types of subjects over different periods of time?

3. What are the present values of the marginal earnings streams when discounted at selected rates?

4. What is the internal rate of return for each

marginal earnings stream?

The findings relating to the four sub-problems were used as the basis for evaluating the profitability of investing in teacher education in Alberta, taking into account the variables of age, experience, sex, training held, training sought, and expected future teaching service. The implications of the findings for social policy dealing with teacher education were also examined.

Delimitations

The research problem was delimited in the following manner. First, the study was restricted to an analysis of the private monetary costs and benefits associated with the general four-year Bachelor of Education degree in the province of Alberta. Secondly, the returns to teacher education were derived from average rates of salary for classroom teachers only. Allowances for administrative, supervisory, consultative, extracurricular, and other special responsibilities, as well as allowances for special training, were excluded from the cash inflows. Thirdly, the focal date for the investment analysis was established as the 1968-69 school year.

Justification for the Study

Part of a Larger Body of Research

The study may be considered a part of a larger body of

research which deals with human capital and with the relationships between education, earnings and productive capacity. The economic study of education has expanded greatly throughout the world and has stimulated a profusion of research and writings. Mary Jean Bowman, an economist at the University of Chicago and former editor of the *Journal of Political Economy*, describes the pace at which economists are adding to the printed pages on the economics of education as "stunning" (1966, p. 112). Elsewhere she writes that the objectives of empirical studies dealing with the economic effects of education relate to consideration of four basic questions:

1. What have been the total human-capital inputs into the productive system, and how have these affected national outputs, that is gross national product, over a period of time?

2. How large a part of society's productive resources has been put into formation of human capital over the past, and how has this compared with what has gone into investment in physical capital?

3. What rates of return have been realized from investments in human capital (in college education, high school education, and so forth)? For example, \$12,000 invested in a college education will add some (empirically observed) amount to average earnings during a man's lifetime over and above what he would earn if he terminated his education with the completion of high school. Taking into account the time pattern of these additions to his annual earnings, what rate of interest on the \$12,000 investment is implied? The \$12,000, merely assumed here, is the human-capital measure needed as the base to which the additions to earnings streams are then related.

4. Looking ahead, how may past, present, and

prospective aggregate investments in formation of human capital be expected to affect the stream of national product in the future (Bowman, 1962, pp. 69-70)?

Bowman's third question indicates that rate-of-return studies -- of which this particular study is an example -- form an important facet of the inquiry into the economics of education. All four areas of investigation are closely interrelated, and the questions would suggest that the research findings have important personal and social implications.

News reports and the literature indicate that these implications have not gone unnoticed by national governments and international agencies. For example, the Economic Council of Canada, which was established by Ottawa "to recommend what government policies ... will best help to realize the potentialities of growth of the economy," has given especial attention to the role of education in some of its annual reviews and special studies. A New York columnist has noted recently that Robert McNamara, the new head of the World Bank, has been impressed by the "returns" to education, implying that these studies may have some influence on the Bank's future policies (Dale, 1969). The evidence would indicate that rate-of-return and other economic studies of education are receiving universal attention.

Research Lacking in Canada

A scarcity of research exists on the returns to particular types and levels of education in the Canadian economy. About a half dozen studies may be found and only a couple of these (Podoluk, 1965; Wilkinson, 1966) are in published form; the remainder consists of unpublished theses. Without adequate research, it becomes more difficult to understand the relationship that exists between education and the national economy, to do social planning, and to ascertain whether the productive resources of the nation could be allocated to more efficient uses. The Economic Council of Canada (1965, p. 91) has stated that if rates of return to education in general were found to be much higher than returns to physical capital, then this would strongly suggest that national productivity could be enhanced by giving relatively greater attention to expanding the educational stock of the labour force as opposed to expanding investment in other assets.

The above comments refer to returns to education in general. However, some specific types of trained or educated manpower may be in higher demand by the economy than others. Under competitive market conditions, high rates of return for particular types of training or education would indicate a deficiency of supply. An analysis of returns to each and every type of education and skill-training could in effect be viewed as an economic analysis of the

shortage of various types of educated manpower. Thus private decisions and social incentives to invest in that type of education which appears to yield the highest return might be prompted by investment analysis. The effect upon economic growth would be expansionary.

Scarcity of Studies on Returns to Teacher Education

Most of the research reports on rate of return to education deal with returns to general levels of education such as elementary school, high school, university, technical and trade schools, and graduate study. Very few reports are to be found which deal with returns to particular types of professional and occupational training such as teaching, medicine, stenography, carpentry, etc. The writer could uncover only one published study on returns to teacher education (Wilkinson, 1966). Three unpublished doctoral studies were found which dealt wholly or in part with teacher education in Canada. Dupuis (1968, 1970) investigated private returns to graduate studies in the Department of Educational Administration at the University of Alberta. Harvey (1967) calculated private internal rates of return and present values as of age eighteen of lifetime earnings streams for teachers with different levels of schooling in Quebec. Stager (1968) analysed both private and social returns to different types of post-secondary education in Ontario. His findings included private and social returns to

teacher education based on lifetime earnings streams.

As far as is known, no investment analysis of either private or social returns to teacher education in Alberta has been made. The investigation reported herein is probably a first attempt. The approach used in this study was unique in one respect in that it treated the investment problem in much greater depth than has been the case with other studies. More variables were taken into account and this procedure yielded findings that were specific to certain sub-groups of subjects rather than general for teachers as a class. Were the usual approach of other studies to be used, all the subjects would have been relegated to one homogeneous class with a uniform marginal earnings stream or time horizon for each subject. The findings would have consisted of returns and rate for those persons who at age eighteen, or thereabouts, chose one, two, three, or four years of teacher education and then spent the rest of their lifetimes teaching. In this study, years of teacher education held, years of experience held, number of years of intended service, and increasing levels of qualification became additional variables. The age of the subject was implicitly taken into account by this combination of variables. The findings, therefore, should be of interest and use to every kind of subject and not just to those who have finished high school and are on the verge of making an occupational choice.

Utility of Knowledge at the Individual Level

Harvey (1967, p. 141) has emphasized that one major assumption underlying the study of returns to investment in schooling is that individuals respond to economic incentives when making educational and career decisions. From whatever information they have at their disposal, individuals will form some perception of the present and future costs and benefits of acquiring more education or training. This perception becomes one of the important factors influencing career choice, the amount of education to acquire before entry into the labour market, the location of work, and the type and quantity of subsequent educational up-grading endeavours.

There are, of course, non-economic factors which are important in career choice and career behavior. Scholastic ability, motivation, interest, family and peer-group influences, the prestige of an occupation, and risks involved are a few of the many additional variables which may be relevant. Some writers stress, however, as do Ginzberg, Ginsberg, Axelrod, & Herma (1951, p. 233), the importance of monetary rewards in career choice. Ginzberg, *et al.*, assert also that persons on the job are motivated more by what the job pays than by any other factor associated with the work.

If economic incentives exert a significant influence on career choice and career behavior, then reliable

information with respect to monetary returns to various post-secondary programs will be useful and important to persons committed to pursuing some form of higher education. Thus individuals who include teacher education in their deliberations about possible careers will be interested in the rate of return or the present value of the lifetime earnings associated with teaching. This information may well be the stimulus needed to induce certain persons either to choose a program of teacher training or to opt for something else. Students who do decide on teaching may, in addition, be prompted by rate-of-return information to take their training and to practice their profession in those provinces or those regions where the returns appear to be highest.

The analysis undertaken in the study reveals the degree of profitability that teachers with partial completion of a degree may expect if they return to university to upgrade their qualifications. This information may have an important influence on whether subjects choose to remain in teaching with the level of training they have, to return to university to take some additional years of education, to study in some other field, to leave the profession for new lines of work, or to migrate to teacher employment in other regions where the financial rewards are more attractive.

In summary, subjects who are motivated by economic incentives will be interested in the kind of information that rate-of-return studies provide. In many cases, this

information may be the critical factor that determines choice of alternative in career and educational decisions. Even subjects who are influenced more by non-monetary than by monetary factors should find rate-of-return information useful.

Implications for Social Policy

Teacher supply and quality. The knowledge which rate-of-return studies provide may be of value in formulating policies respecting teacher supply and quality. Higher financial returns should prompt higher enrolments in teacher education programs. This result is contingent, however, on prospective students having the necessary information about returns for their vocational guidance. Public dissemination of this kind of information would be necessary. Furthermore, if governments and responsible social agencies were aware of how subjects respond to changes in returns to teaching (technically, the elasticity of teacher supply), they might use this information to create incentives for directing more students into teaching and for up-grading the qualifications of the existing teacher force. Return studies are therefore potentially useful in dealing with problems of teacher shortages and teacher quality.

Determination of teacher salary policies. Investment analysis may serve as a conceptual framework upon which to build teacher salary schedules or with which to assess

existing schedules. Taking into account the costs of acquiring teacher education, the salary schedules could be constructed in such a way as to reflect adequate and competitive returns for the investment made. Investment analysis of existing schedules could serve as an objective way of making adjustments in allocation of pay among sub-categories of teachers on the salary grid. Thus, the adjustments could make returns for certain sub-categories more equitable or less equitable depending on the objective to be achieved.

Allocation of resources. Under ideal market conditions, rate of return on investment is a barometer of the efficiency with which scarce productive resources are employed. Social rates of return are more germane to this argument than are private rates of return. Higher rates represent higher net productivity and thus act as guidelines as to what type of capital should be produced with the limited resources that are available. Samuelson & Scott (1968, p. 875) take the position that if investment in machinery yields an interest return of 15%, but investment in people's education returns 20%, then there are grounds to suppose that economic capacity could be expanded by diverting some resources from the production of machine capital to the production of human capital. The same argument supports implementation of economic incentives such as grants, loans, scholarships, subsidies, and other forms of

assistance to encourage individuals to increase their stock of educational capital. When just what types of education should receive attention becomes the specific question, investment analysis of different kinds of educational programs becomes important. Hence, it is necessary to analyse returns to teacher education, to trades training, to secretarial training, to engineering, to arts, -- and in general -- to each and every type of general, vocational, and professional education program.

The use of investment analysis to determine questions of optimum resource allocation as it applies to human capital formation and to educational and economic planning has its critics among economists. Good expositions of what may be misleading about the investor's approach are found in Renshaw (1960), Wilkinson (1965), Vaizey (1961, 1962), and Shaffer (1961). Their arguments draw attention to the fact that the influence of many non-educational factors on income determination is not yet completely understood nor measurable. For example, what effects have imperfections in the labour market (such as restricted entry, militant unionism) on labour income? In addition, intangible costs and spillover benefits defy measurement. Some, like Shaffer, question the extent to which educational costs may be considered investment rather than consumption expenditures. These problems are examined further in later chapters. Despite these and other limitations, many writers hold that

investment analysis does give some insights into planning and resource allocation.

Definition of Terms

A substantial number of terms require definition either because of their technical denotations within the fields of economics and finance, or because of their particularized usage in the study. Since the list of definitions is lengthy, it has been placed into Appendix A as an alphabetically arranged glossary.

CHAPTER II

THE RESEARCH DESIGN

This chapter sets forth the design of the study. It deals with the categorization of the subjects into fifty different sub-groups or types, with the sources and treatment of cost and earnings data, with the selection of discount rates, and lastly, with the mathematics of cash flow analysis.

Conceptualizing a Typology of Subjects

Figure 1 is a model that was devised to conceptualize the types of teacher decision-makers or investors who formed the subjects of the study. The typology is a function of three of the six variables which go into the making of each marginal earnings stream. Each of the three variables makes up one of the dimensions of the model.

The vertical dimension represents full years of teacher education that might be held by the subject at the focal date. The symbol, 0, stands for a Grade XII high school graduate with no years of teacher education; I stands for a person with one year of training; II represents two years of training; and III, three years. These were the only values possible for this variable since the completion of the fourth year of the program would have given subjects a Bachelor of Education degree.

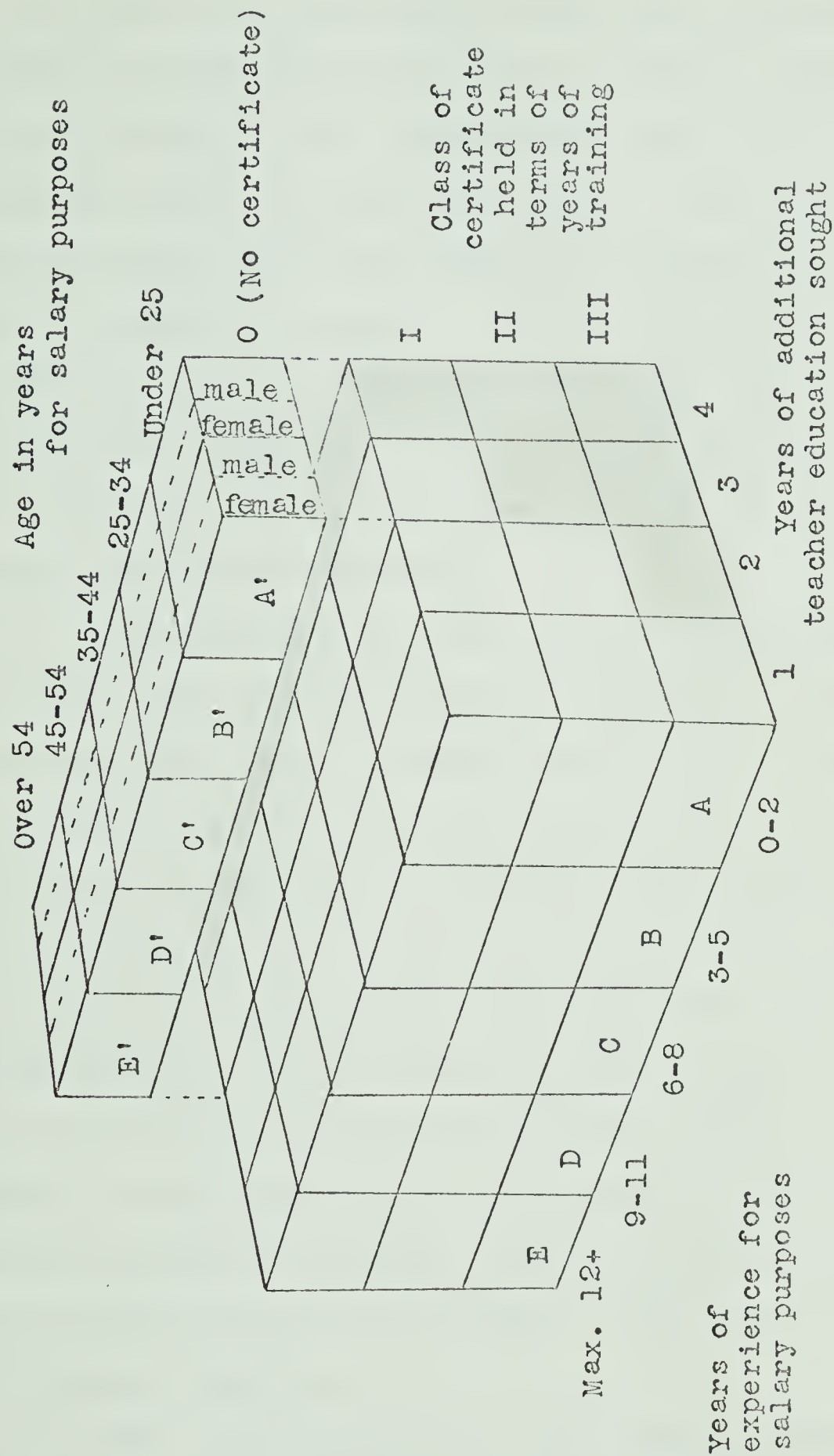


Figure 1. Model to conceptualize types of subjects

The width dimension of the model represents the number of additional full years of teacher education open to the subjects. This varied from one to four years depending upon the number of years of training already held. Thus subjects with three years of training needed one more year to complete a degree. Those with two years could choose one or two additional years; and those with one year could choose among one, two, or three additional years. The unshaded portions of the model indicate the choices that were open to the decision-makers.

Subjects with no years of training had only a choice of three years or four years of university. The reason for this was that Alberta teacher certification regulations as of the focal date, 1968-69, required that students entering a Faculty of Education in Alberta after September 1st, 1968, had to complete at least the first three years of a Bachelor of Education degree program in order to be eligible for certification. This regulation did not apply to persons who were holders of a permanent teacher's certificate issued under former regulations. For example, a person holding a valid teaching certificate obtained after one year of training had the option of investing in one, two, or three years of further training.

The length dimension of the model represents the years of experience or age as a determinant of salary level. To discuss this variable it is necessary to revert to the

original two broad categories of subjects. The first category included high school graduates who were contemplating teaching as a possible career choice but who had no years of training and no teaching certificate. This category is depicted by the raised 0-layer of the model. The second broad category of subjects, shown on the model as layers I, II, and III, included persons with teaching certificates, but with only partial completion of a teaching degree.

The 0-layer category is divided into five age groups using intervals of ten years. Each of the five age intervals was associated with a differentiated average earnings level for high school graduates in the province of Alberta. These age-earnings levels were important for estimating the opportunity costs (foregone earnings) of a program of teacher education. An additional variable, sex, was included for 0-type subjects. Statistics on earnings for high school graduates in Alberta, and in Canada, revealed such large income discrepancies between males and females that it would be unwise not to consider opportunity costs, and hence returns, separately for males and females in this first category. The male-female discrepancies disappeared for the second category because teachers' salaries in Alberta were not differentiated according to sex, and because there was little male-female differentiation in employment.

Each different combination of variants of the three dimensions of the model in Figure 1 resulted in a subject

type with different characteristics and with different expected marginal earnings. The model yielded in total fifty different cubes representing fifty different types of subjects.

The typology of subjects derived from Figure 1 is tabulated in Table 1. The symbols with which the dimensions of the model are labelled were used to compose identifying labels for each type of subject. Thus subject type IA2 was a person with one year of training, and zero to two years of experience, seeking two additional years of teacher training. Subject type OA'3 was an Alberta labour force member with a completed high school education, who was under twenty-five years of age and who was contemplating a three-year teacher education program. The identity labels are descriptive in that the first symbol gives the years of teacher education presently held, the second gives the years of experience of age for salary levels, and the third gives the years of additional teacher education sought. These labels are used as abbreviations throughout the study.

The fourth variable, number of earning years, may now be introduced into the discussion. The present value of and the rate of return on the net earnings stream for each subject type depended on the length of the earning period. The more years that the subject taught after completing his program, the greater would be the return on his investment. Within the limits established by compulsory retirement

TABLE 1
 TYPOLOGY OF SUBJECTS

| Type number | Identifying subject label | Years of teacher education held | Years of experience or age for salary purposes | Years of teacher education sought |
|-------------------|---------------------------|---------------------------------|--|-----------------------------------|
| <u>AGE</u> | | | | |
| 1 | OA'3 male | 0 | Under 25 | 3 |
| 2 | OB'3 male | 0 | 25 - 34 | 3 |
| 3 | OC'3 male | 0 | 35 - 44 | 3 |
| 4 | OD'3 male | 0 | 45 - 54 | 3 |
| 5 | OE'3 male | 0 | Over 54 | 3 |
| 6 | OA'3 female | 0 | Under 25 | 3 |
| 7 | OB'3 female | 0 | 25 - 34 | 3 |
| 8 | OC'3 female | 0 | 35 - 44 | 3 |
| 9 | OD'3 female | 0 | 45 - 54 | 3 |
| 10 | OE'3 female | 0 | Over 54 | 3 |
| 11 | OA'4 male | 0 | Under 25 | 4 |
| 12 | OB'4 male | 0 | 25 - 34 | 4 |
| 13 | OC'4 male | 0 | 35 - 44 | 4 |
| 14 | OD'4 male | 0 | 45 - 54 | 4 |
| 15 | OE'4 male | 0 | Over 54 | 4 |
| 16 | OA'4 female | 0 | Under 25 | 4 |
| 17 | OB'4 female | 0 | 25 - 34 | 4 |
| 18 | OC'4 female | 0 | 35 - 44 | 4 |
| 19 | OD'4 female | 0 | 45 - 54 | 4 |
| 20 | OE'4 female | 0 | Over 54 | 4 |
| <u>EXPERIENCE</u> | | | | |
| 21 | IA1 | 1 | 0 - 2 | 1 |
| 22 | IA2 | 1 | 0 - 2 | 2 |
| 23 | IA3 | 1 | 0 - 2 | 3 |
| 24 | IB1 | 1 | 3 - 5 | 1 |
| 25 | IB2 | 1 | 3 - 5 | 2 |
| 26 | IB3 | 1 | 3 - 5 | 3 |
| 27 | IC1 | 1 | 6 - 8 | 1 |
| 28 | IC2 | 1 | 6 - 8 | 2 |
| 29 | IC3 | 1 | 6 - 8 | 3 |
| 30 | ID1 | 1 | 9 - 11 | 1 |

TABLE 1 (concluded)

| Type number | Identifying subject label | Years of teacher education held | Years of experience or age for salary purposes | Years of teacher education sought |
|----------------|---------------------------------|--|--|--|
| 31 | ID2 | 1 | 9 - 11 | 2 |
| 32 | ID3 | 1 | 9 - 11 | 3 |
| 33 | IE1 | 1 | 12 - max. | 1 |
| 34 | IE2 | 1 | 12 - max. | 2 |
| 35 | IE3 | 1 | 12 - max. | 3 |
| 36 | IIA1 | 2 | 0 - 2 | 1 |
| 37 | IIA2 | 2 | 0 - 2 | 2 |
| 38 | IIB1 | 2 | 3 - 5 | 1 |
| 39 | IIB2 | 2 | 3 - 5 | 2 |
| 40 | IIC1 | 2 | 6 - 8 | 1 |
| 41 | IIC2 | 2 | 6 - 8 | 2 |
| 42 | IID1 | 2 | 9 - 11 | 1 |
| 43 | IID2 | 2 | 9 - 11 | 2 |
| 44 | IIE1 | 2 | 12 - max. | 1 |
| 45 | IIE2 | 2 | 12 - max. | 2 |
| 46 | IIIA1 | 3 | 0 - 2 | 1 |
| 47 | IIIB1 | 3 | 3 - 5 | 1 |
| 48 | IIIC1 | 3 | 6 - 8 | 1 |
| 49 | IIID1 | 3 | 9 - 11 | 1 |
| 50 | IIIE1 | 3 | 12 - max. | 1 |

legislation, the length of the earnings period was at the discretion of the subject, provided that he did not become decertified for some reason or other. As of 1968, there was no legal requirement in Alberta to keep a permanent teaching certificate in good standing through periodic refresher courses. Teacher capital could thus be thought of as not requiring maintenance to continue yielding a flow of benefits for as long as the subject kept teaching.

With the length of the payoff period embodied in the analysis, the private returns for each subject type could be calculated for teaching service of different length. Thus it was possible to take, for example, subject type OA'3 MALE and to find for this subject rates of return and present values for 5, 10, 15, ... \underline{n} years of teaching service with \underline{n} being determined by age of retirement. The findings of the study are reported in this manner; i.e., by length of payoff period. Age sixty-five was assumed to be the normal retirement age and was used to arrive at the maximum possible length of the payoff period.

Treatment of Cost Flows

The appropriate costs to be considered in an investment analysis are only those costs which are incurred because of the decision to make the investment. In this study the costs taken into account were the marginal or extra costs that would arise because of the decision to go to

university. Thus tuition fees are an extra cost, but not living expenses. The latter would exist even if the decision to go to university were negative. Living costs are not due to the investment decision; therefore, they should be excluded from the cost flows. Extra-ordinary living costs incurred because of the decision to go to university, however, would be part of the cost flows. Using this principle for identifying costs, the following expenditure items were included in the cash outflows:

1. Tuition fees
2. Other fees and dues
3. Textbooks
4. Academic expenses on supplies, equipment, clerical work
5. Opportunity costs (earnings stream foregone because of decision)

Excluded from the cost flows were:

1. Transportation
2. Room and board, or household operating costs.
(It was assumed that no extra-ordinary household costs are incurred because of going to university. If anything, living within restricted budgets would probably lower these costs below the ordinary.)
3. Recreation, entertainment, refreshments, etc.

4. Grooming (haircuts, laundry, etc.)
5. Clothing
6. Health
7. Durable items
8. Church and charitable donations

Opportunity costs require a further word of explanation. Items (1) to (4) of the included costs are explicit educational expenditures, paid for by the subject in exchange for goods or services that are received from others. According to Haveman and Knopf (1966, p. 74), an economic valuation of returns to an investment must take into account implicit cost elements as well. These consist not of payments made to others, but of income not received for one's own labour, or for one's own productive factors, because of choosing to commit these factors to a given alternative. Thus if a person chooses to devote his labour to acquiring a university education, he foregoes the income that his labour would have brought him had he applied it to some other endeavour. This is really the cost -- or more specifically, the opportunity cost -- of his labour which is put into study.

Opportunity cost flows extend over the entire lifetime of the capital asset, because the resources committed to that asset could be used to produce revenue in some other way. The opportunity costs in the study consisted not only of earnings foregone while at university, but also earnings

foregone by moving from a lower to a higher earnings stream due to improved teacher qualifications; they were equivalent to the earnings streams that would have prevailed if the subjects had chosen not to acquire more teacher education. The opportunity cost concept incorporated into the cash flow analysis made possible the direct calculation of marginal or extra returns that would accrue to the subject due to choosing one alternative above the other.

Treatment of Earnings Flows

Earnings were defined in the study as income from wages or salaries. The term did not refer to the total income of subjects because revenues from property, outside work, investments, and other sources were excluded from the inflows. Normally, income from these sources should vary directly as salary or wage, so that excluding them from the flows understates returns to some extent.

Earnings flows for teacher subjects were derived from cross-sectional data on the averages of teachers' salary schedules in Alberta as of the focal date. In essence, this meant that earnings profiles were based on the average factor market prices that were offered for teachers with given levels of qualification and experience. Earnings flows for high school graduates were estimated from cross-sectional data based on the averages of actual salaries received by age-education levels of the Alberta labour force.

Attention is drawn to the fact that teacher and high school graduate earnings data differ in the basis of their derivation; the first were based on the averages of teachers' salaries offered, the second, on the averages of labour wages actually received. To be consistent in methodology, the age-education-earnings profiles of high school graduates (the O-type subjects) should be derived from the averages of labour wages offered. These statistics were not available, however, so the averages of wages received were used instead. The inconsistency is acknowledged as one of the limitations of the income data used, but it was assumed that the resultant differences in the derived averages, if any, were not great enough to distort the findings.

The earnings flows did not include any revenues which might be received by the subjects during the period of study. Sources of such revenues include summer work, part-time work, assistantships, scholarships, bursaries, grants, remission of fees, sabbatical leave pay, etc. There were two main reasons for omitting these possible inflows. First, the amount of such revenue was difficult to estimate, and for most undergraduates it probably did not amount to very much. A survey undertaken in 1961-62 by the Dominion Bureau of Statistics (1963) of university student expenditure and income in Canada revealed that education undergraduate students who did have summer jobs managed to save only an average of \$468. About 40% of all education students

reported no income from summer employment.

The second reason for omitting incidental revenues from inflows during the period of study was the premise that the prospective university student who is interested in an investment analysis of returns to teacher education would rather have rate-of-return results that make no assumptions about possible earnings while at university. This means that the subject's decision to go to university is based on knowledge of approximately minimum returns to teacher education. Whether or not he is able to receive any assistance in the form of grants, scholarships, etc., or any income from part-time or summer work, does not enter as a constraint upon the decision to be made. The question he asks is: "Assuming no income during the university period, what returns on my investment can I reasonably expect to get?" If incidental revenues or reduced costs enter the picture, then the present value and rate-of-return figures from the basic analysis are known to be understated.

There are two other qualifications of earnings flow data which need to be noted. The earnings flows were derived from before-tax data. The rationale for this was that the subjects would probably make their decisions on a before-tax basis anyway. The conclusions of Grubel and Edwards (1964) based on findings of their own research and that of others would strongly support this contention. Private rate-of-return studies reported in the literature

show some authors using before-tax data, some using after-tax data, and some using both. Hansen (1963) conducted a study which dealt in part with private rates of return to elementary, high school and college education in the United States and reported findings on both a before-tax and after-tax basis. An examination of his tables reveals that the difference between the two sets of rates of return averages about 1%.

Actually, subtracting income tax from earnings would have no effect upon rates of return if it were not for the progressive nature of the income tax. If the income tax adjustment consisted of subtracting a constant term from the entries in the cost and earnings streams, it would leave marginal differences between the two flows unaffected, and thus would produce no change in the internal rate of return or the present value. If income tax were proportional at all levels, cost and earnings flows would be multiplied by a constant factor at each step in the stream. The effect of this would be the same as multiplying the present value by the factor, which would leave the present value relationships among different streams unchanged. A proportional income tax adjustment would have self-cancelling effects upon the internal rate of return and hence would leave it unaltered. For these reasons researchers have noted that the income tax adjustment has little or no effect upon the results derived in their studies. Wilkinson (1966, p. 563),

for example, found this to be true when he made both a before-tax and an after-tax present value analysis of lifetime earnings for Canadian males for different occupations, using 1961 census data. He observed for either method of computation that there was little difference in the findings; the analysis produced the same results whether before-tax or after-tax data were used.

The last qualification respecting earnings data that needs to be expressed is that no adjustments were made for morbidity, mortality, or unemployment. Again from the subject's point of view, the investment decision to be made was considered as not constrained by thoughts of possible loss of future earnings through illness, early death, or unemployment.

The reason that these qualifications are mentioned is that some researchers take them into account when analysing private returns to education. Morbidity, mortality, unemployment, labour force participation rates and tax deductions do become very important factors when the aggregate social benefits of human capital are being estimated and when investment analysis results are applied at the social level of decision-making. They are less important considerations at the individual level of decision-making for the reasons that have already been mentioned.

Calculating the Marginal Earnings Streams

Once cost flows and earnings flows have been obtained, the calculation of the marginal earnings stream is straightforward; it involves simply finding the difference between the inflows and the outflows. The difference is the net cash flow or the marginal earnings stream. The algebraic sum of this flow gives the undiscounted value, or the present value at a discount rate of 0%. This is the net worth of the investment if the time value of money is disregarded. The relationship may be expressed by the formula

$$V = \sum_{t=1}^n (E_t - C_t) \quad (1)$$

where: V = the undiscounted value of the marginal earnings stream

E_t = earnings for the period t

C_t = costs for the period t

t = the period, ranging from 1, 2, 3, ... n

n = length of the marginal earnings stream in years

Selecting the Discount Rates

If the time value of money is to be taken into account in an investment analysis, the summation of a marginal earnings stream cannot be made unless the marginal earnings for each future time period are converted to a present value at

some focal date. For this purpose a discount rate is needed. Which is the proper discount rate to select is a problem that has plagued economists and investment analysts for a long time; and whatever choice is made is more or less arbitrary (Koulourianos, 1967, p. 49).

Various criteria are used in selecting the discount rate. In the analysis of physical capital investment, the common practice is to use what is called the *cost of capital*. Edge (1965, p. 125) defines cost of capital as the rewards which investors require in order to attract them to put funds into a business. More specifically, cost of capital is the rate of return which bondholders and stockholders expect before they will buy the bonds and stocks of a firm. The cost of capital will vary from firm to firm, but the average returns on common stocks for the financial scene in Canada may be used as one criterion for selecting a discount rate. If the rate has averaged $x\%$ over the last twenty years, then an investor in teacher education may consider that the minimum acceptable return (or reservation rate) for this education should be equal to or greater than $x\%$. There are, of course, factors which may cause him to modify this rate downwards. For example, investments in stocks may be more risky, and the long-term returns less predictable. He may be happier to choose a surer investment (if he considers teacher education to be surer) at a lower rate of interest.

What has been the average rate of return on common stocks in Canada? The answer to this question is based on limited empirical observation rather than on any sort of systematic analysis. Some financial investment firms have begun, with the aid of computer facilities, to make studies of returns to stocks. Burns Bros. and Denton (1969), for example, has found for its recommended stocks a ten-year average return of 11.2% per annum from capital appreciation plus dividends. The Toronto Industrial Index and the Dow-Jones Industrial Average for the same period, however, showed returns of only 5.4% and 2.3% respectively (*Ibid.*). It is difficult to deduce, therefore, from the range of returns what the average cost of capital would be. Edge recommends that for investment analysis a reservation rate of 10% seems reasonable for most practical purposes; however, he adds that the minimum acceptable return should be a dynamic concept that reflects degree of risk and market conditions (p. 130).

With respect to rate of return on corporate capital in the United States, Burns Bros. and Denton report as follows:

The returns from common stocks have only recently been subjected to comprehensive and accurate measurement in a major research project undertaken at the University of Chicago. The University's Graduate School of Business set up the Center for Research in Security Prices (CRISP) in 1960 for this purpose. Returns were measured for all the 1,856 common stocks ever listed on the New York Stock Exchange over the 40 years from 1926 to 1965. Some initial findings were published in 1964 by the CRISP directors, Fisher and Lorie,

and comprehensive findings were published in the July 1968 issue of the University's "Journal of Business".

The study found that while the returns from common stocks have fluctuated considerably from year to year and also varied according to the period of investment, they have on average returned about 10-15% per annum over most of the last decade and 15-20% per annum over most of the previous decade, both before investor's taxes. The return has fluctuated considerably for short investment periods of one or two years but it has varied much less and remained generally within or close to the 10-15% per annum range for longer investment periods of five years or so (pp. 3-4).

Another criterion which is used to select the interest rate for cost-benefit analysis is the interest rate on long-term government bonds. Prest and Turvey (1965) comment that this rate may be regarded academically as the "risk-free rate of interest (p. 698)." As of the focal date, the yield on Canada Savings Bonds was 8% if held to maturity.

Sometimes bank rates on savings deposits are used as the lower limit of discount rates, and the cost of borrowing money as the upper limit (Borus, 1964, p. 381). The latter rate is rather high and should probably be used only when money has to be borrowed to finance an investment project. If the calculated present value of the future earnings stream is positive when the borrowing rate is used for discounting, the project is worthwhile in spite of debt financing.

The discussion of how to select the discount rate can go on and on, and indeed the volume of literature on this

topic is substantial. In the end, one has to agree with Koulourianos that the choice is more or less arbitrary. The best solution seems to be to use a range of rates, and this is what was done in the study. The base rate was established as 8%, the "risk-free" rate of interest on government bonds. A rate above and a rate below this base rate was also selected. At the lower end, 6% was chosen as a rate of return that might satisfy many subjects, not from the point of view that the return was competitive, but from the point of view that teacher education brings both psychic and financial rewards, and that therefore monetary benefits need not be substantial to warrant investing. Six per cent also approximated the bank interest being paid on premium savings accounts. At the upper end, a rate of 12% was selected on the basis that investment in riskier capital, such as common stocks, could produce returns of over 11% in Canada. This upper rate may well be the reservation rate of subjects who find study excruciating and who need to be induced by high returns in order to go to or return to university. In summary, then, the discount rates used in the analysis were 0% (no discount), 6%, 8%, and 12%.

Calculating the Present Values of the Marginal Earnings Streams

Using the selected discount rates, the present values of the marginal earnings streams were found with the formula:

$$PV = \sum_{t=1}^n \frac{E_t - C_t}{(1 + r)^t} \quad (2)$$

where: PV = the present value of the marginal earnings stream

r = the discount rate

t = the period, ranging from period 1, 2, ... n

n = the length of the earnings stream in years

E_t = earnings for period t

C_t = costs for period t

Finding the Internal Rate of Return

The internal rate of return is defined as the discount rate which makes the inflows and outflows equal at a certain point in time, or alternatively, as the discount rate which makes the present value of the net cash flow or marginal earnings stream equal to zero. Formula (2) establishes the equation of value as

$$\sum_{t=1}^n \frac{E_t - C_t}{(1 + r)^t} = 0 \quad (3)$$

With E_t , C_t , n, and t as givens, a value for r must be found that solves the equation. Unfortunately, the solution for r must be found by trial and error. An algebraic solution is possible only when the cash flows take on the nature of an annuity, i.e., uniform flows in each year.

The trial and error procedure may take one of two

tacts. Present value formula (2) may be graphed as a function of r and the internal rate of return read from the graph. The value of r where the graph crosses the abscissa is the required solution, since at this intersection $PV = 0$. In the second approach, the solution is found by a process of *iteration*. Trial rates are picked and successively substituted in the formula until a bracket solution is obtained within which r must lie. If two successive trial rates yield a present value with different signs (one negative and one positive), the actual rate of return lies between these and can be determined by interpolation. Linear interpolation will give a solution for r of reasonable accuracy providing the two trial bracket rates are not more than five percentage points apart (Edge, 1965, pp. 48-49).

Use of Computer Program

The manual calculation of present values and rates of return in investment analysis is a lengthy process which becomes impractical if a large number of problems and long earnings streams are involved. This is one of the disadvantages of the method. To overcome this difficulty, the calculations in the study were performed by use of a special program written for use with the IBM 360/67 computer.

Sources of Data

Cost Data

Information regarding tuition costs, fees and dues for the Faculty of Education was obtained from the registrar's office of the University of Alberta as well as from university calendars. The total of all other academic expenses for Faculty of Education students in Alberta was available from a survey of university student expenditure and income for the year 1968-69 conducted by the Education Division of the Dominion Bureau of Statistics, Ottawa (Dominion Bureau of Statistics, 1969c). Opportunity costs for each subject type were derived from estimated earnings profiles.

Earnings Data

High school graduates. The most current sex-age-earnings data available for high school graduates in Alberta were those contained in the 1961 Census of Canada. Data for Canada as a whole, but not for Alberta, were available up to 1965 from sample surveys undertaken by the Consumer Finance Research Staff of the Dominion Bureau of Statistics (see Dominion Bureau of Statistics, 1968, 1969a). The samples, however, were too small to give statistics by provinces.

The earnings data from the 1961 Census of Canada required for the study were not available in published form, but were obtained from unpublished tabulations through the

cooperation of the Census Division of the Dominion Bureau of Statistics. The problem of up-dating 1961 earnings profiles to 1968 was resolved by the calculation of a conversion index which measured 1961 to 1968 increases in average wages for selected occupations in Alberta. The occupations selected were those reflecting a Grade XII level of education. Statistics on Alberta wages and salaries for this purpose were obtained from the Alberta Bureau of Statistics. A fuller description of how lifetime earnings profiles for high school graduates were constructed is given in Chapter V.

Teacher earnings profiles. Two criteria determined level of teachers' salaries in Alberta: years of teacher education held, and years of teaching experience recognized for salary purposes. Age was not a determinant of salary level. Sex was also eliminated as a variable since salary schedules did not discriminate between male and female teachers. The lifetime earnings profiles for teachers, therefore, were based on experience and education rather than on sex, age, and education as was the case with O-type subjects.

Experience-education earnings profiles for Alberta teachers were derived from the averaging of all teacher salary agreements in the province for the year 1968-69. This information was made readily available by the Teacher Welfare Department of the Alberta Teachers' Association.

Interest Rate Data

The external rates of interest which were used to select discount rates for the present value analysis were based on current data respecting: (1) bank interest rates, (2) interest on federal government bonds, and (3) rates of return to selected common stocks as indicated by dividends and capital appreciation.

Assumptions Underlying the Study

Various qualifications respecting data and procedures have already been discussed in the course of this chapter and in Chapter I. There are, in addition, some fundamental assumptions and problems underlying the treatment of education as human capital that are current issues in the economics of education. The assumptions that are relevant to the study may be summarized as follows:

1. Physical and human capital are conceptually similar and may be analysed by similar techniques.
2. Cash flows in human capital analysis are adequately measured by direct monetary costs and returns.
3. Private marginal earnings arising out of improved educational qualifications represent marginal productivity.
4. Earnings differentials among variously-educated groups are attributable entirely to differences in levels of education held.

5. Analysis of cross-section data provides accurate projections of cost-benefit patterns into the future.

An examination of these assumptions and of their relevance to the research problem is dealt with in the next chapter within the context of human capital theory.

CHAPTER III

THE CONCEPT OF HUMAN CAPITAL

The primary aim of the study was to measure the private returns to teacher education in Alberta. In order to set these measures in their proper theoretical perspective, a brief formulation of the concept of human capital is necessary. To a large extent the conclusions and implications drawn from the findings of the study rest upon the validity of certain assumptions and techniques basic to human capital analysis. Chapter III discusses the nature, the development, the problems, and the assumptions of human capital theory as they relate to the problem investigated.

Definition of Human Capital

Economists define capital as produced goods that can be used as inputs for further production (Samuelson & Scott, 1968, p. 54). In the same sense, human capital refers to the produced stock of skills and capacities embodied in the labour force that can be used for productive activities. Physical capital includes buildings, structures, machines, equipment, inventories, and durable goods all of which are used to produce a flow of outputs, and hence, a flow of income over a future period of time. The stock of human capital consists of education, knowledge, skills, creativity,

mobility, health, longevity, general well-being, and even attitudes. These assets are acquired by human beings through various activities which consume resources, and so they may be thought of as "produced" goods. In the economic process, they increase the quality and the quantity of the labour factor of production and thus promote economic growth and social welfare.

According to Becker (1964, p. 1), investment in human capital includes such activities as education, on-the-job training, migration, and the provision of health and welfare services. How investment of this sort contributes to productivity is explained by Hanson (1969) in the following passage:

In the field of health, expenditures upon communicable disease programs increase the supply of manpower substantially in relation to the size of the expenditure. Other preventive services such as the provision of a safe water supply and various sanitary measures improve the quality and increase the number of man-hours available in the economy within a relatively short time, and also in the long run. Personal health services, such as hospital care and medical care, increase productivity in both the short run and the long run. Various welfare and social security measures may give workers a sense of security as well as faith in the nation, which can increase productivity. Expenditures on education have many complex effects upon productivity. Education is itself an all-embracing category, including formal and informal aspects and communications systems. Finally, the process of growth and development itself creates the capacity to do things better, as health, education, and welfare measures improve the human condition (pp. 30-31).

The investment activity which is of overall interest to the study is education, but the research problem itself is concerned with a particular type of education: teacher training. Teacher training is conceptualized as an investment in human capital. The subject is the investor. He takes away resources from present consumption to invest in himself in order to provide a teaching service of higher quality over a future period of time. The investor receives in exchange for his skilled labour an increased flow of future earnings commensurate with the level of training acquired.

From a social point of view, the training of teachers becomes an investment activity of society. Society becomes the beneficiary of the improved teaching service which more highly qualified individuals are able to provide. The social benefits that are measurable in monetary terms become counted in the national income of the country.

No attempt was made to measure the social benefits of teacher education in Alberta, although this aspect of the problem is treated theoretically in the study. The research was delimited to private returns only.

Some Historical Perspectives

The last decade in the field of economics has been marked by the increasing attention given to the development of human capital theory and to empirical measures of the

essential relationships existing between human resources development and economic growth. Education seems to have received most of the economists' attention, although studies may be found dealing with health, migration, on-the-job training, and the search for economic information. (See, for example, Mincer, 1962; Sjaastad, 1962; Stigler, 1962; Mushkin, 1962b.)

Various approaches are currently being used to ascertain the economic value of education. Koulourianos (1967, Chap. III) classifies these approaches into four categories.

The correlational approach consists of correlating variables representing educational activity with variables reflecting educational performance. The choice of variables correlated depends upon the type of analysis the investigator wishes to make. For example, per capita income may be correlated with school attendance, teacher supply, university enrolments, literacy rates, educational expenditures, and so on.

When the residual approach is used, the researcher attempts to attribute a part of a nation's unexplained economic growth to improvements in the educational stock of the average worker. The residual is a phenomenon which has been observed by economic analysts attempting to explain increases in national productivity in terms of quantitative changes in the trinity of land, labour, and capital. It

has been observed, particularly in the American economy, that a substantial part of economic growth, the residual, was not accounted for by increases in the factors of production. The objective of the residual approach has become explaining what share of this unexpected growth can be attributed to education, research, technology, better management, economies of scale, health, training, and other factors.

The third approach is labelled by Koulourianos as the cost approach. It consists of measuring the net change in the educational stock of the labour force over a period of time by measuring the costs of resources going into educational activity. An estimated rate of return is then applied to the increment in stock to calculate a total return to education. This return can then be compared to the increase in national income for the same period to get the percentage contribution of education to economic growth.

The final approach described by Koulourianos is the present value and rate-of-return analysis which is used in this study. Since the approach has already been examined in detail in Chapters I and II, there is no need to elaborate on it here.

All of the approaches described stem from human capital theory and represent what is going on in the economics of education today. Most of the research activity is a product of the 1960's; however, the underlying theory

itself has origins tracing far back into economic history.

An informative summary of the historical development of the human capital concept as it relates to education has been provided by Bowman (1966a, pp. 113-114; 1966b). She points out that the mercantilists even before Adam Smith's time had some appreciation of the investment-in-man idea, for they readily recognized the importance of human art and ingenuity to progress in raising national incomes. Furthermore, they advocated policies to facilitate the development of human skills. Adam Smith's investment analogy between men and machines (quoted as an introduction to Chapter I, *supra*) was an unambiguous anticipation of current human capital theory, although Smith was concerned with education primarily as a means for the betterment of man, not for the creation of human capital. Following Smith, the classical economists throughout the first half of the nineteenth century did not look upon education from an investment point of view. They saw education for a minority as a national necessity, but they could not envisage economic growth as being dependent upon mass education.

As the nineteenth century unfolded, it brought with it a spirit of individualism and free enterprise. Man was to enjoy freedom of choice and equality of opportunity in the market place and in society. Education was fundamental to this philosophy of individualistic egalitarianism, and political economists became staunch supporters of universal

public education as the foundation of a liberal society. The social benefits flowing from education warranted its being acknowledged as a public good falling under the auspices of the government sector. The battle for universal public education, however, was won more by humanistic than by economic arguments.

In the late nineteenth and early twentieth century the importance of education in economic thought waned. The humanistic view made any materialistic examination of education seem demeaning. Besides, the attention of economists had come to focus on other problems. The 1930's to the 1950's was the era of the Keynesian revolution in economics, and education had no place in Keynes' general theory. Bowman observes that:

Probably at no time in the past two centuries was education further removed from the main streams of Western economics than in the quarter century 1930-1955. Yet within a few years it was to be catapulted into center stage (1966b, p. 30).

What brought about the revival of economic interest in education, or in human capital generally, to give it the prominence that it has today? Bowman (1966b) attributes the cause to several post-World War II developments and to the pioneering researches of Schultz and Denison in the United States.

After the close of World War II, the advanced nations of the world experienced very rapid rates of income growth.

In contrast, the economic growth in developing countries was relatively stagnant. The period saw the emergence of many new nations whose people were determined to find the magic key to the social and economic prosperity enjoyed by other nations. In academic and political circles the need arose to re-examine traditional economic concepts, to look anew at the sources of economic growth, to tackle the problems of emerging nations, and to do economic planning and forecasting. Out of the situation of the times arose the realization that the welfare of a nation depended on the development not only of its physical resources, but its human resources as well. Education was accepted as an important determinant of progress, and a new economics of education was born.

No discussion of the development of the human capital concept would be complete without reference to the path-breaking work of Schultz and Denison. Most economists acknowledge the studies of these two men as the precursors of the modern revolution in the economics of education. Blaug, an English economist, pays tribute to Schultz in the following way:

Rarely is it possible to trace the take-off point of a new subject or a new branch of an old subject to a particular book, much less to a particular article. The 'birth' of the economics of education, however, can be clearly dated from the presidential address of Theodore W. Schultz, Professor of Economics at the University of Chicago and a long-distinguished authority on agricultural economics, to the Annual Meeting of the American

Economic Association in December 1960. This is not to say that nobody used the label 'economics of education' before 1960, but simply that most economists before 1960 were not aware of the fact that widely different observed economic phenomena could be rendered intelligible by the idea of human capital formation. The result was a sudden acceleration of research in this area and a sudden proliferation of publications concerned with the economic value of education ... (Blaug, 1968, p. 11).

The work which brought Schultz this recognition was his cost-approach analysis of the contribution of the educational stock of the labour force to growth in the real national income of the United States during the period 1929 to 1957 (see Schultz, 1961a, 1961b). He found that when a rate of return of 11% was applied to the net human capital formed through education for this period, it represented approximately 21% of the rise in real national income. A comprehensive account of Schultz's thought and work concerning education as human capital is found in his essay *The Economic Value of Education* (1963).

Denison's name has become associated with the residual approach. His major study was not a study of the economics of education as such but a comprehensive analysis of all the factors which helped to explain the residual in the economic growth of the United States (see Denison, 1962a, 1962b). He identified and measured the contributions of a long list of factors including increased experience and better utilization of women workers, advance of knowledge, and economies of scale, but he paid particular attention to

education because of the magnitude of its contribution. He found that education accounted for 23% of the growth in total national income and for 42% of the growth in per capita income over the period 1927-1957.

Denison made explicit a very important assumption in arriving at his findings: He held that only 60% of the observed earnings differentials of people with varying educational backgrounds is due to education; the remainder is attributable to other factors such as ability, race, sex, and region. The 60% figure, picked by Denison as more or less an educated guess and later revised by him to 66%, is commonly referred to as the Denison coefficient, *alpha*. Most studies now incorporate the Denison coefficient, with *alpha* varying from 0.60 for secondary schooling to 0.66 for higher education. Studies undertaken by other researchers using multiple regression techniques have tended to verify that the coefficient has empirical validity (Morgan & David, 1963; Blaug, 1965, pp. 214-215). According to Blaug (1965, p. 214), education has been found to explain between 60% to 88% of the earnings differentials.

Schultz' and Denison's work is important because of the impact that it has had in economics and education. The traditional concept of capital was extended to include investment in human beings. A new vista to theory-building and research was opened, bringing with it new strategies of inquiry into the economic value of education and of other

forms of human capital. Extensions of Schultz' and Denison's work have contributed new insights and new solutions over a wider and wider range of economic problems. The human capital concept has revamped the theoretical perspective of social and economic planners and policy makers. The studies of Denison and Schultz helped usher into the 1960's what Mary Jean Bowman has referred to as the human investment revolution and the new economics of education. This development is, in her words, "... a synthesis of important older elements in economics, a forging of new tools, an opening of fresh vistas, and also the ground on which sharp battles are waged among different schools of economists (1966b, p. 42)."

Assumptions and Problems

Certain problems and assumptions are fundamental to research based on the concept of human capital and are the source of debate among economists. The purpose of this section is to identify these problems and assumptions and to make explicit how they are handled in the study.

Problems of Conceptualization and Measurement

One of the assumptions basic to human capital and to this study is that activities like education are conceptually similar to investment in physical capital and may be measured and analysed with meaningful results by using physical

capital techniques.

A definition of physical capital and human capital has already been given in this chapter and the similarity between the two noted. However, there are difficulties in treating education as capital which give rise to two sets of problems. First, there are problems in conceptualizing what constitutes the costs and returns of education; and second, there are problems in measuring these costs and returns. Shaffer (1961) presents a comprehensive commentary on these problems which, he concludes, are so great that "economics has little to gain and much to lose by the universal application of the capital concept to man (p. 1026)." Shaffer fears that human capital analysis may yield erroneous guidelines with respect to such matters as resource allocation and manpower planning.

The consumption-versus-investment issue. The extent to which educational expenditures should be viewed as consumption or investment presents a conceptual difficulty in human capital theory. Schultz (1963, p. 37) and Koulourianos (1967, p. 48) both state that all studies assume -- as a rule implicitly -- that all costs are investment costs. Since it may be argued that educational expenditures have a consumption component, the rather arbitrary rule of assigning all expenditures to investment seems unwarranted and serves to overstate the investment costs of education. The argument for this rule seems to be that both individuals and society

expend resources on education primarily for the sake of long-term monetary and psychic rewards, and therefore present consumption benefits are very small and, perhaps for many individuals, non-existent.

The consumption-versus-investment issue may be illustrated by reference to the problem investigated in this study. If a teacher returns to university to obtain more teacher training in anticipation of higher income in the future, and if this higher income is in fact realized, then the act is fully analogous to an investment in capital. The expenditures involved are investment costs. Suppose however that the teacher chooses to buy more teacher education simply because he enjoys education *per se*, and suppose further that he neither anticipates nor realizes any tangible financial rewards in the future. He is now buying education as a consumer good in the same sense that he buys a pair of shoes or an admission to the football game; his expenditure could not properly be classified as investment.

It is probably correct to say that all decisions to provide or to buy educational services are stimulated in part by consumption aspects and in part by investment prospects. Similarly, the educational experience itself exhibits both consumption and investment effects. The problem in human capital theory is to proportion these effects correctly and to allocate costs accordingly. So far,

as Schultz admits (1963, p. 37), no logical bases for such allocations have been formulated. The problem remains a critical one because of the deductive conclusions that may follow from it. For example, Vaizey (1962, p. 26) points out that if education is mainly consumption, its amount can be raised or lowered without any long-run effect on the economy. The proposition that education affects economic growth derives fully from the premise that it is analogous to investment. Hypothetically, if education were mainly consumption, the causal relation now assumed between it and income would be reversed. Higher personal and national income would be the cause and not the effect of people buying more educational services.

The position taken in this study with regard to the consumption-investment issue is that all costs as outlined in Chapter II are assumed to be investment costs. Regardless of the motivation of the subjects, they stand to gain financially in the form of increased future salary flows if they get credit for higher teacher qualifications. In addition, they enjoy both the immediate consumption benefits of further education and its future value as a durable consumer good.

Costs of investment. Stager (1968, p. 6) lists the private costs of education as including tuition fees, expenditures for academic supplies, books, travel to and from educational institutions, and earnings foregone during

the period of study. Does this list represent an adequate conceptualization of costs? The answer varies from scholar to scholar. For example, Vaizey (1962, p. 43) expresses doubt that the inclusion of foregone earnings is justifiable, while Blaug (1965) and Schultz (1963) present vigorous arguments for their inclusion. Aside from foregone earnings, one may question Stager's inclusion of travel to and from educational institutions as really being a cost incurred because of the investment decision. To illustrate, if the subjects of this study chose not to attend university, they would still incur the costs of travel to and from work. Travel costs are not uniquely investment-produced and should be left out of the cost flows of the investment, as they have been in this study.

The costs referred to so far have been direct, tangible, and measurable, but even so they present problems of conceptualization. The problem gets more complex should indirect and less tangible costs be considered (and they usually are not). For example, the valuation of physical capital always takes into account maintenance costs. Are there analogous costs in human capital? Shaffer (1961) would argue that the knowledge and training teachers acquire become obsolete over time and require maintenance and refurbishing. Living the life of a professional teacher, keeping up-to-date with changes in education, refreshing one's stock of knowledge and training, and fulfilling

socially-held expectations of teaching require of the teacher a continual flow of costs throughout his lifetime. Yet these costs are not included in outflows, and if they were, how would they be measured? One may also argue that part of the cost of being a professional is longer hours of work. In comparing earnings streams for higher and lower levels of education some standardization of work-hours may be warranted.

Non-pecuniary or psychic costs present another problem of conceptualization and measurement. Moving away from friends, dislocation of family, leaving a fiancée behind as fair game for other suitors, sacrifice of present consumption, fear of academic failure, dislike of study, and other such variables may be determining influences in an investment decision for subjects seeking further education. These psychic costs may be too high a price to pay for what is to be gained. They may well affect the minimum return which a subject would be willing to respond to in considering an educational investment.

Other than to be mentioned, indirect, intangible, and psychic costs have not been counted in rate-of-return studies. This study is no exception for the analysis utilizes only those direct costs which are listed in Chapter II. Whether other costs should be a part of human capital analysis remains an unsettled question.

The social costs of teacher education are also excluded from the study, although they are described here for information purposes. Stager (1968, p. 6) would include as direct social costs expenditures on salaries, books, supplies and equipment required to operate the Faculties of Education. Indirect social costs would include depreciation, imputed interest, tax exemptions, the value of output foregone because students are not in the labour force, and students' expenditures for books, supplies, and travel. In other words, the social costs include all expenditures borne by society in the operation of teacher training institutions.

Returns to investment. The conceptualization and measurement of private and social returns to educational investment present the same kinds of problems as do costs. Schultz (1963, p. 38) indicates that returns to education may be conveniently grouped into three categories. First, there are the immediate consumption benefits that give rise to the consumption-investment issue already discussed. A second class of benefits takes on the form of consumer capital or durable goods which yield a stream of future satisfactions to the educated person. Greater enjoyment of leisure time, a heightened appreciation of the fine arts and literature, a better understanding of the social and natural environment are examples of these kinds of satisfactions. Thirdly, education forms producer capital which enhances the person's capacity for producing goods and services which he can sell

in return for money income and for which he may receive income in kind. This third category has been the most important one in studies of the economic value of education.

No one can pretend to know or to be able to list all the private benefits which flow to an individual from an investment in education, nor can all of these benefits be evaluated in monetary terms. For this reason only the direct financial returns in the form of differential incomes or earnings have been investigated by rate of return studies. Likewise in this study, the analysis focuses only on that aspect of benefits which can be quantified as marginal increases in earnings streams.

The social and external benefits of education are many, and again, defy complete identification and quantification. Weisbrod (1964) writes that these benefits refer to "anything that pushes outward the utility possibility function for the society (p. 17)," and illustrates the meaning of this definition by stating that it would include:

(1) anything which increases production possibilities, such as increased labor productivity; (2) anything which reduces the need to incur costs such as for law enforcement, thereby releasing resources for alternative uses; and (3) anything which increases welfare possibilities directly, such as development of public-spiritedness or social consciousness for ones' neighbor (p. 17).

When researchers attempt to measure the social returns to education they generally exclude external benefits and use as an approximation for social returns the before-tax

lifetime earnings of individuals with varying levels of schooling (Koulourianos, 1967, p. 38). The result of this approach, as Becker (1964, p. 118) points out, is that the social rates of return are found to be less than private rates and greatly understate the social productivity of education.

Summary. The problems and assumptions related to conceptualizing and measuring private and social costs and returns in educational investment have provided grounds for the most severe criticisms of the human capital orientation. However, the proponents of the human capital approach are quite aware of the limitations thus placed on the validity of their findings. These limitations apply to the validity of this study as well. The fact that all the complexities of costs and benefits can not be resolved does not make investment analysis meaningless or of little value in decision-making. As Weisbrod (1962) notes:

... even partial measurement may disclose benefits sufficiently sizable to indicate a profitable investment, so that consideration of non-measured benefits would, a fortiori, support the expenditure decision (p. 122).

The Marginal Productivity Assumption

One of the practical applications claimed for human capital theory and rate-of-return studies is that they furnish guidelines with respect to allocation of resources both for the individual and for society. In discussing the

justification of this study in Chapter I, the argument was advanced that knowledge of rates of return to occupational training may have an important influence on career decisions and career behavior. In addition, this knowledge may have important social implications, providing certain assumptions are accepted. One of the objectives of the study was to examine what implications the findings held for social policy dealing with teacher education. The validity of the discussion on the uses of rate-of-return findings is dependent in large measure on the degree of validity that attaches to the assumption that an individuals' marginal income reflects marginal productivity. This section will examine the basic importance of this assumption.

If a teacher, as in this study, returns to university for one more year of training, he will go back into service at a higher rate of salary. Does the marginal increase in his salary represent the value of a real increase in the quantity or the quality of the teaching service he later renders? If the salary differential does not represent a real productivity differential, the higher salary arises from market imperfections or administered prices, the end result of which is an inflation of prices for teacher labour. On the other hand, if higher income represents higher productivity, and furthermore, if a cost-benefit analysis shows higher private and social rates of return on teacher education than on some alternative type of training, policy

guidelines as to labour supply and socially optimum resource allocations are indicated.

In general, marginal productivity theory states that at the margin productivity is maximized if resources are allocated first to that alternative which produces the highest rate of return (Koulourianos, 1967, p. 80). According to this rule, returns to teaching, providing they can be adequately measured and compared, provide useful clues in making social policy decisions about teacher training. Similarly if the rate of return is higher to human capital than to physical capital, reallocation of investment from one sector to the other is indicated up to the point where the rates become equalized.

Blaug, Peston, & Ziderman (1967, p. 58) write that in an economy with a free labour market a rising rate of return suggests a shortage of supply, whereas a falling rate of return is evidence of insufficient demand. Rate-of-return analyses should therefore constitute an important feature of manpower planning by signifying that it may be advantageous to encourage one type of educational program over another. This type of policy becomes groundless, however, if the marginal earnings due to additional education do not reflect gains in productivity.

Several writers (Blaug, *et al.*, 1967, p. 12; Koulourianos, 1967, p. 43; Stager, 1968, p. 36) have listed the labour market imperfections which may invalidate the

assumption that higher income for higher qualifications represents marginal productivity. The higher income may be due instead to factors such as collective power held by some profession or sector, tradition, arbitrary rules, over-estimation of education required for the job, conspicuous consumption of education on the part of employing firms, and restriction of supply through control of entry and inadequate training facilities.

This study assumes that the higher salaries received by teachers for higher educational qualifications accurately portray greater productivity and market demand. Higher qualifications embodied in the teacher labour force produce a flow of higher quality teaching services, and perhaps an increase in quantity as well if higher training is at all associated with longer working hours. Higher salaries for teachers with better training may be interpreted as a public, money-backed demand for high quality teaching. This does not deny that labour market imperfections may result in some price fixing; the uncertainty lies in not knowing if these imperfections are significant enough to invalidate rate-of-return calculations. By and large, earnings should reflect the push and pull of market forces and hence are continuously being brought into line with relative productivities. Support for this position may be found among many writers in the economics of education field. (See, for example, Denison, 1962a, p. 26; Blaug, 1965, p. 229; Benson, 1966,

p. 32; Bowman, 1966b, p. 37; Schultz, 1967).

The Ceteris Paribus Assumption

The *ceteris paribus* assumption (other things being equal) in rate-of-return studies alleges that differences in earnings to be found among different groups are entirely attributable to differences in levels of schooling. Other determinants of earnings differentials are held either to be insignificant or equalized among groups. Renshaw (1960) is one writer who argued at the outset of the new era in human capital theory that this assumption was questionable. He pointed out that factors other than formal education may readily affect income differentials. A list of such factors would include ability, ambition, experience, race, sex, religion, parents' education, father's occupation, geographical region, prestige and status of educational institution, informal education, on-the-job training, and many other similar variables. Any one of these factors or any combination of them may exert an upward or a downward bias on levels of earnings.

As pointed out earlier in this chapter, most studies now employ the Denison coefficient or multiple regression analysis to eliminate the bias of income determinants other than formal education. No such adjustments to earnings differentials among levels of training was necessary in this study because of the nature of teachers' salary

schedules in Alberta. Teacher salary scales and related matters were negotiated collectively between teachers and employing school boards, and a teacher's placement on the scale was determined entirely by years of training and experience recognized for salary purposes. Thus a subject who had acquired an additional year of teacher education could fully expect to re-enter service at the next higher pay level. In most cases, school boards in Alberta accepted for salary increments teaching experience gained in other school systems.

Assumptions Respecting Cross-Sectional Data

Investment analysis of marginal earnings streams associated with different levels of education presupposes that the lifetime earnings profiles of subjects under study are known. In fact, however, no longitudinal data of future lifetime earnings are actually available. What is available are cross-sectional data at a moment in time which give earnings according to age, education, sex, occupation, and other factors. Many studies rely on the periodic national census as the source of cross-section data, but draw also on various levels of government and on many occupational associations, both of whom are becoming increasingly involved in keeping more comprehensive statistics on wages and salaries.

Blaug, *et al.* (1967, p. 62) explain that the common

procedure in rate-of-return studies is to use cross-sectional age-education-earnings profiles as proxy measures of the lifetime earnings patterns of given educated individuals aging over time. Earnings profiles derived in this manner are expressed in the constant currency of a base year, and the relative patterns of wage and salary distribution are assumed to remain stable. Miller (1960) has produced some evidence using historical data for the United States to support the contention that earnings differentials and patterns of distribution of labour income remain relatively unchanged over long periods of time. If pattern stability is indeed a feature of labour income, then rate-of-return calculations will produce identical results regardless of the base year from which the cross-sectional data are derived, providing, of course, that cost flow patterns are also stable. When the analysis is in terms of present value rather than rate of return, comparability of results between years can be attained by conversion to the constant currency of any given base year.

Bowman (1968, p. 256) states that economists accept cross-sectional age-earnings data as the best available measures of real lifetime earnings and productivity patterns. Hunt (1963, p. 309) suggests that one reason why cross-sectional data provide good estimates is that factors which exert an upward bias are offset by other factors working in the opposite direction. To illustrate, income

differentials at any particular age level are in part determined by the relative supplies of variously educated manpower. As the supply of educated manpower increases, future income differentials tend to become smaller than indicated by cross-sectional data. However as technology advances, this tendency is offset by a shift in demand for labour away from the unskilled to the skilled worker. Counter-balancing forces such as these explain why existing patterns of labour income differentials among workers with different levels of skills, training, and education are maintained over time. There are, no doubt, other factors as well which act to perpetuate these patterns. For example, differentials may be due in part to traditional notions and conventions held by society with respect to what appropriate levels of pay should be for various levels of education. Also collective bargaining in any one industry or sector usually produces wage changes that keep pace with general wage level movements in the economy as a whole; thus, the relative salary positions of various employee groups *vis-a-vis* other groups tends to remain unchanged.

The stability feature of labour income distribution makes possible the use of cross-sectional data as good estimates of future earnings profiles. In addition, cross-sectional data have certain advantages over real life-cycle data when used in cost-benefit analysis. According to Blaug (1965, p. 224), they are free from the influence of

the business cycle, they implicitly provide estimates in money of constant purchasing power, they provide a more reliable method of measuring opportunity costs, and finally, they reflect the way choices are actually made by individual decisions-makers -- i.e., by cross-sectional comparisons in the present.

Several criticisms of the use of cross-sectional data in rate-of-return studies have been made by various writers. Renshaw (1960, p. 323) cautions that income differentials at one point in time may prove to be poor indicators of differentials in some future period. Other writers, including Blaug (1967), and Becker (1964), point out that cross-section data should be adjusted for secular growth in an expanding economy. Blaug and Becker make these adjustments in their own calculations by assuming a secular growth in real income of 2% per year; but in most studies, as in this one, this adjustment is not made. Blaug, Preston, & Ziderman (1967, p. 63) demonstrate mathematically that any rate-of-return figure can be approximately corrected for the secular trend by adding to it the estimated percentage rate of real growth in the economy. Thus if the calculated rate of return to general education is found to be 12%, and growth in real productivity averages 2% per year, then the rate of return to general education adjusted for economic growth is approximately 14%.

Stager (1968, p. 67) lists some of the other kinds of adjustments that may be necessary to estimate more accurately the expected lifetime earnings from the actual present earnings of different age-education or experience-education groups. These include adjustments for risk of unemployment, non-participation in the labour force, death before retirement, failure or incompleteness rate in academic studies, and occupational success rate in the world of work. Morbidity is another factor which may be added to this list. Where data are available, researchers often modify cross-sectional statistics to get more refined estimates of lifetime income profiles.

Most of the adjustments to cross-sectional data mentioned by Stager are more applicable to social than to private cost-benefit analysis and for this reason have not been incorporated into the study. There is one exception, however. The earnings profiles for high school graduates are implicitly corrected for unemployment due to the nature of the 1961 Census data. The figures reported by the Census covered average earnings during the previous twelve months of all persons who either possessed a job or who were looking for work during the week prior to the Census.

In private rate-of-return studies of higher education there is no doubt that risk of failure both academically and occupationally is of sufficient magnitude to warrant being taken into account by the subject who makes the investment.

He may do this simply by learning what the failure rates are and using these to arrive at an estimate of his own probability of success. He may also make adjustments for risk by modifying his reservation rate or by discounting marginal earnings streams at a higher rate. It should be noted, however, that the risk of failing in or of dropping out from an occupation necessitates adjustments only if the magnitude or the time-shape of the marginal earnings stream is affected. Switching from one occupation to another after completion of higher education -- as for example, from teaching to life insurance -- may leave average level of earnings relatively unchanged.

Some Concluding Statements

Various problems and assumptions relating to the capital analysis of education have been reviewed and their treatment in this study explicitly described. The purpose of this review was to explain as clearly as possible the limitations of the cost-benefit approach, but in doing so, some doubt may have been cast on its validity and usefulness. There are certain redeeming features of cost-benefit analysis, as yet not mentioned, which serve to offset some of the difficulties and make them less critical.

Many of the factors which impinge upon educational costs and benefits may be treated as things being equal whose effects cancel out in marginal analysis. Danielson (1970) in

an exercise on a study by Ashenfelter and Mooney (1968) shows that adjustments to cross-sectional data for secular growth, mortality, and income tax are self-cancelling and do not substantially affect rates of return. Increases in measured returns produced by secular growth corrections were found to be offset by decreases resulting from adjustments for the other two factors. Thus, the exclusion of some elements or the omission of certain data adjustments in marginal analysis of capital investment may have no effect on either the absolute or the relative magnitudes of the findings. This feature of marginal analysis may be illustrated mathematically by reference to the problem investigated in the study.

Let A_t represent the earnings of a teacher in period t , and B_t the earnings of the same teacher after he has acquired an increment of education. If an adjustment, $-M_t$, is made to the earnings, A_t , to allow for, say, the maintenance costs of teacher education, the adjusted earnings would become $A_t - M_t$. One might safely argue that the maintenance costs would not differ significantly if the teacher held more years of teacher training. Thus the adjustment to the higher earnings, B_t , would also be $-M_t$, and these earnings would become $B_t - M_t$. In the marginal analysis of the two earnings streams, the difference in earnings for period t represents the extra earnings the

teacher acquires because of his extra education. This difference is equal to $B_t - A_t$ and is the same even if the adjusted earnings are used: $(B_t - M_t) - (A_t - M_t) = B_t - A_t$. Since the adjustments are self-cancelling, their exclusion from the earnings streams does not make any difference to the marginal earnings, provided, of course, that their magnitudes are equal or nearly equal.

By the same process it may be shown that adjustments made by multiplication by a constant factor such as the Denison coefficient will change the absolute magnitudes of earnings streams, but not their relative magnitudes. For most problems, knowledge of relative magnitudes suffices.

Another feature of rate-of-return analysis which serves to offset errors made in projecting earnings profiles has been observed by Blaug (1965, p. 224). He notes that if the first five to ten years of an earnings stream have been accurately forecast, significant shifts in earnings patterns thereafter do not substantially affect rate-of-return or present value results.

In conclusion, the general observation may be made that many complexities attach to rate-of-return studies of education. Many conceptual issues have yet to be resolved. The need for more comprehensive and more accurate measures of costs and benefits, and for more refinement and standardization of methodology is evident. Readers of the

research literature need to be cautioned that varying qualifications apply to the data of different studies and have to be borne in mind when comparisons of findings are made. However, despite the limitations imposed by assumptions and problems, human capital theory and research can serve to produce a meaningful analysis of cost-benefit relationships in education without necessarily having to capture all the complexities of the phenomenon under study.

CHAPTER IV

REVIEW OF SELECTED RESEARCH

In this chapter selected research dealing with cost-benefit analysis of teacher education and general university or college education is reviewed to form a backdrop against which the findings of the study may be compared. The particular focus of the review is on Canadian research although several American and English studies are included to give an indication of the returns to higher education reported in these countries. Only present value or rate-of-return analyses are selected, which means that investigations using the other approaches mentioned in Chapter III have been excluded.

Before beginning the review, several general observations may be made respecting rate-of-return studies in education. The great bulk of the research has occurred in the United States, although reports may be found on work undertaken in other countries such as Canada, England, Israel (Klinov-Malul, 1961), India (Harberger, 1965; Gounden, 1967), Nigeria (Bowles, 1965), and in at least four Latin American countries (Carnoy, 1967). Returns to all levels of education and training have been studied; this includes private and social returns to elementary and high school education, college and graduate education, vocational education, and on-the-job training and retraining.

So far, general levels of education as opposed to specific types of educational programs have received most of the attention. In addition, the rate-of-return analysis seems to have been favoured over the present value analysis, since most findings are reported in terms of the former.

The volume of theoretical and research literature written in the last decade on the economic returns to education has been enormous, making comprehensive reviews or summaries impractical. Anyone who studies the field must develop from the specific problem under consideration some criteria of selectivity for reviewing the literature. An important help in undertaking this task has been the contribution made by Mark Blaug, a British economist. He has collated, published, up-dated, and supplemented an annotated bibliography of over one thousand titles dealing with the economics of education (Blaug, 1966). This bibliography is a primary source list for persons who need to or wish to explore the research literature further than has been done in this chapter.

Canadian Studies on Returns to Teacher Education

Studies on returns to teacher education in Canada have been completed by Wilkinson (1966), Harvey (1967), Stager (1968), and Dupuis (1970). In addition, two Alberta studies, one dealing with private returns to teacher education taken after the completion of an arts or science

degree (Wilson, 1970), and the other dealing with private returns to teacher training in vocational education (Wallace, 1970) were undertaken concurrently with this study. The results of the latter two investigations are discussed in a later chapter in conjunction with this study's findings.

Wilkinson (1966) conducted a present value analysis of private returns to teaching and to other occupations in Canada using mainly 1961 Census of Canada data adjusted for mortality. He presents tables showing both before-tax and after-tax calculations, and notes that the income tax adjustment made little difference to the findings and conclusions of the study. Discount rates of 5%, 8%, and 10% were used to discount earnings streams over a lifetime period ranging from fourteen years of age (end of elementary schooling) and seventeen years of age (end of secondary schooling) to assumed retirement at age sixty-five. What Wilkinson calculated for teacher education was the net present value at different rates of the average lifetime returns to a four-year training program. He found this value to be \$84,000 at 5%, \$51,600 at 8%, and \$39,200 at 10%. The net present value of private returns to completed secondary schooling for males in Canada were found to be \$56,100, \$33,300, and \$23,700 respectively at the same discount rates. Comparison of these latter figures with the first set indicates the gain in the net present value of

lifetime earnings that results from acquiring a four-year teaching degree over and above completed secondary schooling.

Wilkinson was also able to compare the percentage rates of increase in private net present values of lifetime earnings for teachers and engineers over the period 1957 to 1961. Whereas the present value for teachers increased by about 19% using constant 1957 dollars, the present value for engineers stayed relatively constant with an increase of only 4% to 5%. At the same time enrolment in teachers' colleges increased by 133.1% and in engineering by 3.8%. Wilkinson concluded that the rising returns to teachers relative to engineers may be at least partly responsible for the increasing enrolments in colleges of education relative to engineering colleges. Of greater importance, however, was his more general conclusion -- though put forth with reservation -- that individuals may implicitly consider disparities in present values of lifetime earnings when choosing among occupations or when selecting the amount of education to obtain prior to entering an occupation.

An expansive analysis of private returns to teacher education in Quebec was undertaken by Harvey (1967). Of all studies reviewed in this chapter, Harvey's most closely resembles the present study in that it reports rates of return to successively higher levels of teacher qualifications. Table 2 shows some of these rates for male Protestant teachers. The rates for female Protestant teachers are identical with

TABLE 2

MEDIAN PRIVATE RATES OF RETURN TO TEACHER EDUCATION
IN QUEBEC FOR PROTESTANT MALES, 1965^a

| Years of teacher education held | Additional years of teacher education obtained | | | |
|--|---|-----------------|-------------------|-----|
| | 1 | 2 | 3 | 4 |
| 0 | 12% | 10% | 13% ^b | 14% |
| 1 | 11 | 16 ^b | 14 | |
| 2 | 18 ^b | 13 | | |
| 3 | 8 | | | |
| 4 | 5 | 5 | 3 (Grad. studies) | |

^aSource: Harvey (1967, Table 14).

^bIndicates a B.A. level of qualification.

the figures in Table 2 in almost all cases, with the largest difference amounting to only 2%. The rates of return for Catholic teachers, corresponding to those given in Table 2, were about one-half of those for Protestant teachers. They showed more variation because the salary schedules of Catholic school board differentiated between male and female, and elementary and secondary teachers. The median rates of return for Catholic secondary male teachers averaged, respectively 7.0% and 8.1% lower than the rates in Table 2. For Catholic female teachers the rates at the secondary level were 6.4%, and at the elementary level 5.7%, lower on the average than the figures in Table 2. Harvey noted that returns to male Catholic teachers in Quebec were rather low when compared with returns to investment in physical capital and with returns to other occupations. He also observed wide regional differences in rates of return to teaching in Quebec, attributing this primarily to the wide discrepancies in rates of pay to be found among different school districts.

Harvey was able to compare the rates of return to teaching with rates of return to a general college education, to some specific male and female occupations, and to various professional, technical, and clerical civil service positions all within the province of Quebec. Rates of return for all college male graduates were 15%, for all

college female graduates 10%, for engineers 18%, for accountants 16%, and for nurses 5%. The corresponding rates for four years of training for Protestant male teachers and for Protestant female teachers were 14% and 12% respectively. Thus Protestant female teachers, and in some comparisons, Catholic female teachers seemed to fare better than their counterparts in other occupations. In most cases, returns to Protestant men were slightly lower, and to Catholic men much lower in the comparison. Comparisons with civil service positions revealed that at lower levels of qualification teacher returns were generally higher. At higher levels of training, returns to teaching were greater in some categories and less in others. To complete the comparisons, Harvey also calculated the private rates of return to all degreed male and female teachers in Canada, using 1961 Census data. These calculations showed returns of 17% for men and 21% for women; these rates were higher than the Quebec teacher rates for both sexes.

Certain qualifications respecting Harvey's data and method need to be noted for the sake of comparing his results with the findings in this study. Harvey used 1961 Census of Canada data as well as teacher salary schedules in Quebec as of 1964-65. His marginal earnings streams ran from age eighteen to age ninety and they were adjusted for pension deductions and benefits, and for mortality after age sixty-five. In addition, Harvey included annual sums of

\$867 (females) and \$1,050 (males) for scholarship and employment income during the period of college study. The pension and mortality adjustments would serve to depress rates of return, while the scholarship and employment incomes would tend to raise them.

Harvey concluded from his analysis that salary schedules and schemes of scholarships could serve as useful incentives to increase student enrolments in teachers' colleges and to encourage teachers in service to up-grade their qualifications through further study. He suggested, furthermore, that these devices could be used to induce teacher mobility among school districts as well.

Stager (1968, 1969) researched the social and private net monetary returns to investment in different university faculties and other post-secondary institutions in Ontario in 1961, reporting his results in three forms: net present value, internal rate of return, and benefit/cost ratio. His study included returns to teacher education acquired at university (four years of arts or science plus one year of education), and at teachers' college (one year of training). Earnings data were derived from the 1961 Census of Canada and were adjusted for mortality, labour force participation rates and income tax. The present value analysis utilized a 5% discount rate. For Ontario males, the returns to teacher training acquired at university calculated as net present values and internal

rates of return were as follows (1968, Table IV:3):

| Net present value | | Internal rate of return | |
|-------------------|----------------|-------------------------|----------------|
| <u>Social</u> | <u>Private</u> | <u>Social</u> | <u>Private</u> |
| \$10,600 | \$11,100 | 8.6% | 10.3% |

Stager (1968) stated that "Since there are no formal salary differentials for male and female school teachers, the returns for female graduates would have been approximately the same as for males (p. 188)." However, the returns to female teachers are almost certain to be higher than the above figures indicate, since the opportunity costs for males are generally much higher than for females. Whether Stager considered the differences in opportunity costs when reaching the conclusion quoted is not certain; it would appear that he did not, in which case the female returns would be considerably understated.

Stager's findings respecting returns to one year of teachers' college education were as follows (1968, Table IV:3):

| | Net present value | | Internal rate of return | |
|---------|-------------------|----------------|-------------------------|----------------|
| | <u>Social</u> | <u>Private</u> | <u>Social</u> | <u>Private</u> |
| Males | \$ 4,400 | \$ 5,100 | 42.3% | 78.6% |
| Females | 17,400 | 17,700 | 89.7 | 173.5 |

The teachers' college figures definitely do show the advantage accruing to females due to lower opportunity

costs. The rates of return turned out to be abnormally high and Stager (1968, p. 19) explained that this was due to the one-year training period and the fact that earnings differentials in the first few years were high and little affected by discounting.

Stager's teachers' college returns illustrate the advantage of using both an internal rate-of-return and a present value analysis, especially where a private investment decision is concerned. Both methods give more information than either used alone. The decision-maker looking at Stager's rate-of-return data can only conclude that there is no investment as profitable as spending a year in teachers' college. However, when he looks at the absolute magnitude of the returns as indicated by the net present values, he realizes that this is really a small investment project even though its yield is high. Other career choices with very low rates of return may be found which yield much higher present values. For these reasons, the present value analysis is probably the more useful one if the decision-maker is interested most in maximizing the absolute value of returns. If on the other hand he has limited investment funds, he will want to put them into projects whose returns are highest as indicated by the internal rate of return.

The final research to be reviewed in this section deals with the analysis of returns to graduate rather than undergraduate studies in teacher education. Dupuis (1970)

surveyed nearly the entire population of individuals who had completed a graduate degree either at the master's level or the doctoral level in the Department of Educational Administration at the University of Alberta in the years 1963 to 1968. He calculated the average algebraic sum of the undiscounted marginal lifetime earnings of the subjects according to the types of occupations they entered upon graduation. He reported the results in this way:

In the case of doctoral students it varied from an average of \$36,000 for deans and principals to \$49,000 for executives. Professors could anticipate earning \$33,400, while government employees could expect to earn \$42,100 more as a result of undertaking the program. For Master's students the range was from \$28,000 for principals to \$40,000 for assistant principals, with superintendents being second lowest at \$35,900 and "others" earning \$39,600 (p. 23).

Dupuis also found the internal rate of return for Ph. D. degrees (two-year residency) to be 10%, and for Master's degrees (one-year residency) to be 13%. The percentages, when compared to Table 2, appear to be twice as high as the returns found by Harvey for graduate teacher education in Quebec.

Dupuis' major conclusion was that, for the sample studied, investment in a graduate program in educational administration was worthwhile. It proved to be more profitable than investment in stocks, bonds, and physical capital.

Canadian Studies on Returns to Higher Education

Podoluk (1965) used 1961 Census of Canada data adjusted for mortality to calculate the private rates of return to general education in Canada for the male labour force. The return to secondary schooling was found to be 16.3%, to a university degree over elementary schooling 17.1%, and to a university degree over secondary schooling 19.7%.¹ The latter percentage is of most interest because it may be compared to the rates of return for teachers with degrees reported by Harvey and Stager. This comparison is made in Table 3.

Both Harvey's and Stager's findings would indicate that returns to teaching degrees in Quebec and Ontario fall behind the average returns which might be expected for a university education in Canada. Yet Harvey's calculations for rates of return for Canadian male and female teachers with university degrees places teachers almost on a par with other male degree holders. This suggests that for Canada as a whole the private rate of return for a teaching degree is equivalent to the overall rate of return for all university degrees, but that significant variations in returns to teaching may be found among provinces. An

¹The category "University Degree" in the 1961 Census included any and all university degrees. Thus individuals with two or more degrees and with graduate degrees were also included.

TABLE 3

SOME COMPARISONS OF PRIVATE RATES OF RETURN FOR
TEACHING DEGREES AND UNIVERSITY DEGREES IN
CANADA, 1961

| Investigator | Subjects studied | Private rates of return |
|--------------|--|-------------------------|
| Podoluk | Canadian males, university degree | 19.7% |
| <hr/> | | |
| Harvey | <u>Quebec</u> | |
| | Protestant male teachers (4-year program) | 14 % |
| | Catholic male teachers (4-year program) | 3-5% |
| | <u>Canada</u> | |
| | Male teachers, university degree | 17 % |
| | Female teachers, university degree | 21 % |
| <hr/> | | |
| Stager | Ontario male teachers (5-year program) | 10.3% |

important observation to be made from Table 3 is the tendency for female teacher graduates to show higher returns than male degree holders.

A word of warning must again be introduced at this point with respect to comparing either rates of return or present values that have been computed by different researchers. Differences such as those appearing in Table 3 are as likely to be due to differences in data sources and treatment as to real differences in marginal earnings streams of the subjects being compared. Because of different assumptions and adjustments used by researchers, the absolute values of results are not always comparable. The best that can be expected from such findings is that they will show general tendencies and ordinal magnitudes. More accurate data and more standardization of methodology are required to alleviate this problem of comparability and to corroborate conclusions reached by earlier studies.

Mention was made earlier that Stager's research included an analysis of returns to a broad spectrum of post-secondary education programs in Ontario. Only his calculations relative to teacher education have been reviewed so far. Some of the other findings may now be examined to gain a wider perspective of the relationships that exist among returns to different kinds of education in Ontario. This is done in Table 4. Returns for male students in dentistry are highest for all faculties studied. Arts and

TABLE 4

PRIVATE RETURNS TO POST-SECONDARY EDUCATION IN
ONTARIO, 1961^a

| Educational program | Net present value at 5% | Rate of return |
|---|----------------------------|-------------------|
| <u>Males: university</u> | | |
| Bachelor and first degrees | \$ 26,000 | 15.4% |
| Dentistry (highest return) | 80,900 | 30.2 |
| Arts and Science (median return) | 28,600 | 17.4 |
| Education | 11,100 | 10.3 |
| Social work | -5,300 | 0.9 |
| <u>Females: university</u> | | |
| Household science | 9,700 | 16.7 |
| Nursing | 9,300 | 17.6 |
| Physiotherapy | 5,100 | 13.8 |
| Social work | 2,900 | 8.0 |
| <u>Males: non-degree institutions</u> | | |
| Institutes of technology | 8,700 | 12.9 |
| Provincial schools | 5,800 | 13.3 |
| <u>Females: non-degree institutions</u> | | |
| Private business schools | 6,300 | 37.7 |
| Nursing schools | 5,400 | 29.5 |

^aSource: Stager, 1969.

science graduates (males) fall in the median range of returns, while education graduates place fifteenth out of the eighteen faculties considered. Private returns for males in teaching in Ontario would, therefore, appear relatively unattractive, even though the present value of the marginal earnings is somewhat higher than the corresponding figures for graduates of provincial schools and institutes of technology. The present value of the return to female teachers, however, (if the male figure can be taken as applying to females) is highest in comparison to the other female categories, even though the rates of return indicate that funds are more efficiently invested by females in other faculties.

Returns to Education in Other Countries

Many more cost-benefit analyses of educational programs have been undertaken in the United States than in this country, but only two studies -- Hansen (1963) and Becker (1964) -- have been selected for review here. In addition, some estimates by Blaug for Great Britain are included. These figures give some idea of how returns for comparable educational programs in these two countries compare with Canada.

Hansen calculated the private before-tax and after-tax rates of return, and social rates of return to successively higher increments of schooling in the United States,

using 1949 Census data adjusted for mortality. The before-tax private returns and the social returns for completed secondary and college education were as follows:

| | <u>Social rate of return</u> | <u>Private rate of return</u> |
|--|----------------------------------|-----------------------------------|
| Four years high school over Grade 8 | 11.4% | 15.3% |
| Four years college over high school | 15.6 | 16.7 |

Podoluk's (1965) calculations of 16.3% for completed secondary schooling and 19.7% for university degrees for Canadian males were higher in both cases. Stager's rate of 15.4% for Ontario male university graduates was lower than Hansen's finding for college graduates in the United States. Since Hansen's calculations were based on 1949 as the base year and the Canadian results on 1961, one may suspect that the time difference may be important. However, later calculations by Becker (1964, Table 14) for the United States for 1958, 1959, and 1961, showed returns between 14% to 15%, still below the Podoluk figure, but not greatly different from Hansen's results for 1949.

Hansen advocated that marginal rates such as he calculated, especially the social rates of return, could be used as the bases for allocating public resources spent on education among several types of schooling. Resource allocation between education and other sectors of the economy could also be guided by these rates.

Blaug (1965), using only crude data and the Denison adjustment for ability and other factors, estimated social and private rates of return for secondary and higher education in Great Britain for the base year 1963 as follows:

| | <u>Social rate of return</u> | <u>Private rate of return</u> |
|---------------------------------|----------------------------------|-----------------------------------|
| Three years high school | 12.5% | 13% |
| Three years higher education | 6.5 | 14 |

Except for the lower social rate of return to higher education, Blaug's results are comparable to the results for the United States. His private rate of return to higher education is lower than the Canadian figure. Blaug's results must be accepted with caution, however, since he used data which were by-products of several surveys conducted for other reasons. In Britain, there is no basic source of age-education-income data such as is available from the American and Canadian Census.

Some Conclusions from the Review of Research

In addition to the studies reviewed in this chapter, the writer has summarized some thirty other research articles dealing with rate-of-return and present value analysis of education (Dibski, 1969). On the basis of this survey, certain conclusions seem warranted. These are listed below and deal not only with returns to teacher

training and university education, but also with the more general problem of the economic value of all education.

1. Whether viewed from an individual or a social perspective, a high correlation exists between education on the one hand, and productivity and income on the other.

2. The nature of the relationship between educational costs and benefits is amenable to scientific examination which produces interpretable results for the economic guidance of individuals and society.

3. Investment analysis of education as human capital is not free from serious shortcomings and challengeable assumptions. Theory and methodology are in greater need of repair for the study of social returns than for the study of private returns.

4. The developed Western nations may be underinvesting in secondary and higher education since the research evidence shows with considerable consistency that social and private returns to these levels of education are higher than returns to investment in other forms of capital. Some evidence to the contrary has been found for underdeveloped economies.

5. The few Canadian studies that have been undertaken show that rates of return to secondary and university schooling are higher in Canada than in the United States or Britain. In addition, returns to university education exceed returns to secondary education; the reverse is true for the United

States. This implies a greater demand for, or a greater deficiency of, university graduates in Canada.

6. The limited evidence available for the Canadian teaching force indicates that, Canada-wide, the private return for a teaching degree is roughly equivalent to the return for a university education, that women teachers enjoy higher returns than men, and that in Ontario and Quebec the return for a teaching degree falls below the average return for all university degrees combined.

7. American studies show that on-the-job training and retraining have the same effects on observed earnings as formal education.

8. American studies reveal that significantly lower rates of return and life incomes are received by Negroes and by labour in the South. Ethnic, religious and regional disparities in income are characteristic of the Canadian labour scene as well, even within the teacher sector as Harvey's findings for Quebec show.

CHAPTER V

ANALYSIS OF THE DATA

The central problem of the study was to make a cash flow analysis of private marginal returns to investment in higher increments of teacher education in Alberta. The analysis was delineated by four sub-problems directed at estimating present values and rates of return from measures of private monetary costs and benefits. The findings of the analysis are given in this chapter.

Sub-Problem 1

What are the estimated private costs of and private returns to the investment in given years of teacher education by different types of subjects?

This sub-problem involved measuring the costs of going to university in Alberta to study education as well as estimating the teaching salaries that might be anticipated over the working lifetimes of different types of subjects. The total population of subjects was sub-classified on the basis of three variables: (1) years of teacher education held, (2) years of age or experience, and (3) years of additional teacher education sought. For one stratum of the total subject group, sex formed an additional variable. The sub-classification resulted in the formation of fifty different sub-groups or subject types. A year-by-year cost

stream and an earnings stream characteristic of each subgroup were then constructed.

The cost stream or outflows consisted not only of academic costs associated with taking teacher education, but also of opportunity costs represented by the lifetime earnings foregone as a result of the decision to enrol in a Faculty of Education. Since the private costs include foregone earnings, it is more convenient to report and discuss the earnings data first.

The earnings data required for the analysis took three forms. First it was necessary to construct an experience-education lifetime earnings profile for Alberta teachers. As explained in Chapter II, cross-sectional data from 1968-69 teachers' salary schedules from all Alberta school systems were used for this purpose. By averaging the rates of salary paid according to teaching experience and teacher education held, lifetime earnings profiles for teachers with one, two, three and four years of education were formulated. The results are shown in Table 5.

The additional earnings information required took the form of lifetime age-income profiles for males and for females with completed secondary schooling in the Alberta labour force. These two profiles provided the opportunity cost streams for the O-type subjects who decided to take initial teacher training. The most recent sex-age-earnings

TABLE 5

LIFETIME EXPERIENCE-EDUCATION PROFILES OF AVERAGE
SALARIES FOR ALBERTA TEACHERS 1968-69

| Years of teaching experience | Years of teacher education | | | |
|------------------------------------|----------------------------|----------|----------|----------|
| | 1 | 2 | 3 | 4 |
| 0 | \$ 4,171 | \$ 4,752 | \$ 5,486 | \$ 6,638 |
| 1 | 4,383 | 5,055 | 5,811 | 7,050 |
| 2 | 4,608 | 5,350 | 6,131 | 7,472 |
| 3 | 4,868 | 5,650 | 6,451 | 7,870 |
| 4 | 5,155 | 5,948 | 6,768 | 8,278 |
| 5 | 5,423 | 6,241 | 7,080 | 8,678 |
| 6 | 5,687 | 6,522 | 7,382 | 9,077 |
| 7 | 5,930 | 6,795 | 7,683 | 9,476 |
| 8 | 6,138 | 7,059 | 7,978 | 9,870 |
| 9 | 6,270 | 7,284 | 8,255 | 10,260 |
| 10 | 6,377 | 7,434 | 8,490 | 10,648 |
| 11 | 6,377 | 7,434 | 8,493 | 10,733 |
| 12 | 6,377 | 7,434 | 8,493 | 10,765 |
| To retirement | 6,377 | 7,434 | 8,493 | 10,765 |

data found for high school graduates in Alberta were those contained in unpublished records of the 1961 Census of Canada.¹ These data appear in Table 6.

As may be noted in Table 6, the 1961 Census reported earnings as averages over ten-year age periods. The O-type subject profiles require, however, year-by-year age-income figures. These may be produced by applying the average earnings reported for an interval to each age in the interval. If this is done, however, the time pattern of the earnings is distorted and the present value and rate-of-return calculations are sensitive to this distortion. A better approximation of the actual age-earnings profiles results if a linear interpolation is generated for each ten-year interval using the average figures in Table 6 as the midpoints of the intervals. This interpolative procedure was followed by Stager (1968, p. 141) for producing lifetime earnings profiles in his study, and it was adopted here for the same purpose.

Since 1968 was set as the base year of the study, the next problem faced in estimating earnings streams for O-type subjects was to convert interpolated 1961 earnings profiles to estimated 1968 profiles. For this purpose a conversion

¹Data for Canada as a whole, but not for Alberta are available up to 1965. See Dominion Bureau of Statistics (1968, 1969a).

TABLE 6

AVERAGE INCOME FROM WAGES AND SALARIES FOR ALBERTA
WAGE EARNERS WITH COMPLETED SECONDARY SCHOOLING,
1961

| Age interval (years of age) | Average annual wage or salary | |
|--------------------------------|-------------------------------|------------------------|
| | Male wage earners | Female wage earners |
| 15 - 24 | \$ 2,311 | \$ 1,788 |
| 25 - 34 | 4,489 | 2,405 |
| 35 - 44 | 5,238 | 2,378 |
| 45 - 54 | 5,419 | 2,610 |
| 55 - 64 | 4,818 | 2,733 |

Source: Unpublished 1961 Census of Canada tabulations
obtained from the Census Division, Dominion
Bureau of Statistics, Ottawa.

index was calculated by using 1961 to 1968 increases in average wages and salaries for selected occupations in Alberta. The occupations selected were those reflecting a Grade XII level of education. In all, the 1961-68 average wage movements for thirty female and twenty-nine male occupations were used to derive indexes for both males and females. The indexes were then used to convert the 1961 earnings profiles of high school graduates to the base year 1968. The occupations selected and the respective 1961-68 wages and indexes are shown in Tables A (males) and B (females) in Appendix B. With the index for 1961 equalling 100, the mean conversion index for males was computed as 133.41 and for females as 131.17. Table C of the same Appendix contains further calculations of the same nature using wage data from other sources to verify the reliability of the original computations.

Lifetime age-earnings profiles for male and female secondary school graduates for the base year 1968 were produced from interpolated 1961 profiles by use of the two conversion indexes. The results, showing both 1961 and 1968 annual earnings for ages fifteen to sixty-four inclusive, are contained in Table 7 for males and Table 8 for females. At each age there is a substantial difference between male earnings and female earnings which demonstrates the necessity of including sex as a variable for O-type subjects. No distinction between male and female earnings

TABLE 7

INTERPOLATED 1961 AND ESTIMATED 1968 AVERAGE ANNUAL
INCOME FROM WAGES AND SALARIES BY YEARS OF AGE FOR
MALE WAGE EARNERS IN ALBERTA WITH COMPLETED
SECONDARY SCHOOLING

| Age | Annual earnings | | Age | Annual earnings | |
|------|--------------------|-------------------|------|--------------------|-------------------|
| | 1961 | 1968 ^b | | 1961 | 1968 ^b |
| 15 | \$ 1,331 | \$ 1,776 | 40 | \$ 5,247 | \$ 7,000 |
| 16 | 1,548 | 2,065 | 41 | 5,265 | 7,024 |
| 17 | 1,767 | 2,357 | 42 | 5,283 | 7,048 |
| 18 | 1,984 | 2,647 | 43 | 5,301 | 7,072 |
| 19 | 2,202 | 2,938 | 44 | 5,319 | 7,096 |
| 19.5 | 2,311 ^a | 3,083 | 45 | 5,338 | 7,121 |
| | | | 46 | 5,356 | 7,145 |
| 20 | 2,420 | 3,229 | 47 | 5,374 | 7,169 |
| 21 | 2,638 | 3,519 | 48 | 5,392 | 7,193 |
| 22 | 2,856 | 3,810 | 49 | 5,410 | 7,217 |
| 23 | 3,073 | 4,100 | | | |
| 24 | 3,291 | 4,390 | 49.5 | 5,419 ^a | 7,229 |
| | | | | | |
| 25 | 3,509 | 4,681 | 50 | 5,389 | 7,189 |
| 26 | 3,727 | 4,972 | 51 | 5,329 | 7,109 |
| 27 | 3,945 | 5,263 | 52 | 5,268 | 7,028 |
| 28 | 4,162 | 5,553 | 53 | 5,209 | 6,949 |
| 29 | 4,380 | 5,843 | 54 | 5,149 | 6,869 |
| 29.5 | 4,489 ^a | 5,989 | 55 | 5,089 | 6,789 |
| | | | 56 | 5,028 | 6,708 |
| 30 | 4,562 | 6,038 | 57 | 4,968 | 6,628 |
| 31 | 4,600 | 6,137 | 58 | 4,908 | 6,548 |
| 32 | 4,676 | 6,238 | 59 | 4,848 | 6,468 |
| 33 | 4,751 | 6,338 | | | |
| 34 | 4,826 | 6,438 | 59.5 | 4,818 ^a | 6,428 |
| | | | | | |
| 35 | 4,901 | 6,538 | 60 | 4,788 | 6,388 |
| 36 | 4,975 | 6,638 | 61 | 4,728 | 6,308 |
| 37 | 5,050 | 6,737 | 62 | 4,668 | 6,228 |
| 38 | 5,125 | 6,837 | 63 | 4,608 | 6,148 |
| 39 | 5,200 | 6,937 | 64 | 4,548 | 6,067 |
| 39.5 | 5,238 ^a | 6,988 | | | |

^aAverage earnings figures from Table 6.

^bEstimated by multiplying interpolated 1961 figures by conversion factor 1.3341.

TABLE 8

INTERPOLATED 1961 AND ESTIMATED 1968 AVERAGE ANNUAL
INCOME FROM WAGES AND SALARIES BY YEARS OF AGE FOR
FEMALE WAGE EARNERS IN ALBERTA WITH COMPLETED
SECONDARY SCHOOLING

| Age | Annual earnings | | Age | Annual earnings | |
|------|--------------------|-------------------|------|--------------------|-------------------|
| | 1961 | 1968 ^b | | 1961 | 1968 ^b |
| 15 | \$ 1,511 | \$ 1,982 | 40 | \$ 2,390 | \$ 3,134 |
| 16 | 1,572 | 2,062 | 41 | 2,413 | 3,165 |
| 17 | 1,634 | 2,143 | 42 | 2,436 | 3,195 |
| 18 | 1,695 | 2,223 | 43 | 2,460 | 3,227 |
| 19 | 1,757 | 2,305 | 44 | 2,483 | 3,257 |
| 19.5 | 1,788 ^a | 2,345 | 45 | 2,506 | 3,287 |
| 20 | 1,819 | 2,386 | 46 | 2,529 | 3,317 |
| 21 | 1,881 | 2,467 | 47 | 2,552 | 3,347 |
| 22 | 1,942 | 2,547 | 48 | 2,576 | 3,379 |
| 23 | 2,004 | 2,629 | 49 | 2,599 | 3,409 |
| 24 | 2,066 | 2,710 | 49.5 | 2,610 ^a | 3,424 |
| 25 | 2,128 | 2,791 | 50 | 2,616 | 3,431 |
| 26 | 2,189 | 2,871 | 51 | 2,628 | 3,447 |
| 27 | 2,251 | 2,953 | 52 | 2,641 | 3,464 |
| 28 | 2,313 | 3,034 | 53 | 2,653 | 3,480 |
| 29 | 2,374 | 3,114 | 54 | 2,665 | 3,496 |
| 29.5 | 2,405 ^a | 3,155 | 55 | 2,678 | 3,513 |
| 30 | 2,404 | 3,153 | 56 | 2,690 | 3,528 |
| 31 | 2,401 | 3,150 | 57 | 2,702 | 3,544 |
| 32 | 2,399 | 3,147 | 58 | 2,714 | 3,560 |
| 33 | 2,396 | 3,143 | 59 | 2,727 | 3,577 |
| 34 | 2,393 | 3,138 | 59.5 | 2,733 ^a | 3,585 |
| 35 | 2,390 | 3,135 | 60 | 2,739 | 3,592 |
| 36 | 2,388 | 3,132 | 61 | 2,751 | 3,608 |
| 37 | 2,385 | 3,128 | 62 | 2,764 | 3,626 |
| 38 | 2,382 | 3,124 | 63 | 2,776 | 3,641 |
| 39 | 2,380 | 3,122 | 64 | 2,788 | 3,657 |
| 39.5 | 2,378 ^a | 3,119 | | | |

^aAverage earnings figures from Table 6.

^bEstimated by multiplying interpolated 1961 figures by conversion factor 1.3117.

needs to be made in Table 6, since teachers' salary schedules in Alberta were the same for both sexes.

In summary, Tables 6, 7, and 8 contain the basic earnings data from which private returns to investment in one, two, three, and four years of teacher education by the fifty different subject types were derived. In addition these tables provided the opportunity cost data which had to be included with academic costs to make up total cash outflows for each investment problem.

Turning now to costs, these were defined as including, besides opportunity costs, the outlays on tuition, fees, textbooks, academic supplies, equipment, and clerical or other academically required services. Total academic costs were found to average \$591 for each year of attendance in a Faculty of Education at an Alberta university. These costs are itemized in Table 9.

Sub-Problem 2

What resultant net cash flow or marginal earnings stream may be expected for different types of subjects over different periods of time?

This sub-problem required using the costs and earnings data derived for sub-problem 1 to build net cash flow streams over the working lifetimes of the fifty different subject types; thus, fifty net earnings streams were the outcome. To display the fifty streams here would be too cumbersome,

TABLE 9
ANNUAL ACADEMIC EXPENSES FOR TEACHER EDUCATION
IN ALBERTA, 1968-69

| | | |
|--|---|-------------------------|
| Registration fee | - | \$ 10.00 |
| Tuition fee | - | 400.00 |
| Students' Union and other fees | - | 28.00 |
| Other academic expenses on texts, supplies, services ^a | - | <u>153.00</u> |
| Total academic expenses | - | <u><u>\$ 591.00</u></u> |

^aFrom Dominion Bureau of Statistics (1969c, Table 33B).
All other cost data were obtained from the Registrar,
University of Alberta, for the academic year 1968-69.

but an example is given in Table 10 to illustrate the process involved. The net earnings stream for subject type OA'4 MALE over a fifteen-year teaching period is used in the illustration. The OA'4 MALE subject represents individuals who are high school graduates with no teacher education, who at some age under twenty-four (say at age eighteen) decide to complete a Bachelor of Education degree. At most they may expect a teaching lifetime of forty to forty-five years after completing the degree before they are forced into retirement. Thus the maximum length of the payoff period for this sub-group was set at forty-five years. However, in the example in Table 10 the marginal earnings stream for only the first nineteen years is shown. This covers the four-year period of study and a teaching period, or payoff period, of fifteen years.

Column (2) of Table 10 shows the total academic costs for each year of study. Column (3) gives the opportunity costs or the earnings stream that is foregone by the subject as a result of his decision to acquire a Bachelor of Education degree. The opportunity costs consist of the earnings the subject might have expected to make as a labour force member with a completed secondary education. These figures come from Table 7, starting at age eighteen. All costs are added to give the total cost outflows year-by-year in column (4). The earnings inflows in column (5) show that no income is assumed during the period of study, but in year

TABLE 10
DERIVATION OF MARGINAL EARNINGS STREAM FOR SUBJECT TYPE OA'4 MALE

| | (1) Year | (2) Total academic costs | (3) Opportunity costs | (4) Total cost outflows C_t | (5) Earnings inflows E_t | (6) Marginal earnings stream $E_t - C_t$ |
|--------------------------|-------------|-----------------------------------|-----------------------------|--|-------------------------------------|--|
| Period of study | 1 | \$ 591 | \$2,647 | \$3,238 | \$ 0 | \$-3,238 |
| | 2 | 591 | 2,938 | 3,529 | 0 | -3,529 |
| | 3 | 591 | 3,229 | 3,820 | 0 | -3,820 |
| | 4 | 591 | 3,519 | 4,110 | 0 | -4,110 |
| Period of teaching | 5 | | 3,810 | 3,810 | 6,638 | 2,828 |
| | 6 | | 4,100 | 4,100 | 7,050 | 2,950 |
| | 7 | | 4,390 | 4,390 | 7,472 | 3,082 |
| | 8 | | 4,681 | 4,681 | 7,870 | 3,189 |
| | 9 | | 4,972 | 4,972 | 8,278 | 3,306 |
| | 10 | | 5,263 | 5,263 | 8,678 | 3,415 |
| | 11 | | 5,553 | 5,553 | 9,077 | 3,524 |
| | 12 | | 5,843 | 5,843 | 9,476 | 3,633 |
| | 13 | | 6,038 | 6,038 | 9,870 | 3,832 |
| | 14 | | 6,137 | 6,137 | 10,260 | 4,123 |
| | 15 | | 6,238 | 6,238 | 10,648 | 4,410 |
| | 16 | | 6,338 | 6,338 | 10,733 | 4,395 |
| | 17 | | 6,438 | 6,438 | 10,765 | 4,327 |
| | 18 | | 6,538 | 6,538 | 10,765 | 4,227 |
| | 19 | | 6,638 | 6,638 | 10,765 | 4,127 |

five, the subject may expect to make the average salary paid to teachers with a Bachelor of Education degree and no experience. This figure and the subsequent salary figures, which increase with teaching experience, come from Table 5. When the cost outflows are subtracted from the earnings inflows in each year, the marginal or net earnings stream as shown in column (6) is generated. It is this net earnings stream which enters into the calculation of the capitalized value of and the rate of return on an investment in human capital in the form of a four-year Bachelor of Education degree. These calculations form the subject matter of sub-problems 3 and 4.

Sub-Problem 3

What are the present values of the marginal earnings streams when discounted at selected rates?

The analytical procedures undertaken in sub-problems 1 and 2 yielded fifty lifetime marginal earnings streams of the type illustrated in column (6) of Table 10. The next step of the analysis was to find the present value or the capitalized value of the streams at selected rates of discount. The basic discount rate chosen was 8%, but a 6% rate and a 12% rate were also used to give a range of discounts which might more nearly accommodate the variations in time rate preferences held by different prospective investors. The rationale and the problems associated with

choosing the discount rates are dealt with in Chapter II. The task associated with sub-problem 3 is to show how the discount rates were applied to the net earnings streams and to report the results of this application.

The marginal earnings stream for the OA'4 MALE subject which was produced in Table 10 may be used to illustrate the present value analysis. Fourteen years of this stream are reproduced in Table 11, column (2). In column (3) of Table 11 the stream is cumulated without discounting (or discounted at 0% and cumulated). In column (4) it is discounted at 6% and cumulated at this rate of discount in column (5). The formula in the header of each column indicates the mathematical operations performed. When the marginal earnings for each year in a cash flow stream are discounted back to a focal date at some rate of interest, as is done in column (4); and when the discounted marginal earnings are summed for a period of (n) years, as in column (5); the resultant sums are the present values of the marginal earnings stream when it is (n) years long. Thus from Table 11, the present value in the base year 1968 of an OA'4 MALE marginal earnings stream ten years in length discounted at 6% is \$-551. If the flows are considered over a length of fourteen years, their discounted present value becomes \$6,731, and so forth.

The length in years of an earnings stream depends upon how long a productive lifetime a particular investment has.

TABLE 11

PRESENT VALUE ANALYSIS OF THE MARGINAL EARNINGS
STREAM FOR SUBJECT TYPE OA'4 MALE

| (1) Year | (2) Marginal earnings stream discounted at 0% | (3) Present value at 0% | (4) Marginal earnings stream discounted at 6% | (5) Present value at 6% |
|-------------|--|-------------------------------|--|-------------------------------------|
| (t) | $(E_t - C_t)$ | $\sum (E_t - C_t)$ | $\frac{(E_t - C_t)}{(1.06)^t}$ | $\sum \frac{(E_t - C_t)}{(1.06)^t}$ |
| 1 | \$ - 3,238 | \$ - 3,238 | \$ - 3,055 | \$ - 3,055 |
| 2 | - 3,529 | - 6,767 | - 3,141 | - 6,196 |
| 3 | - 3,820 | - 10,587 | - 3,207 | - 9,403 |
| 4 | - 4,110 | - 14,697 | - 3,255 | - 12,658 |
| 5 | 2,828 | - 11,869 | 2,113 | - 10,545 |
| 6 | 2,950 | - 8,919 | 2,080 | - 8,465 |
| 7 | 3,082 | - 5,837 | 2,050 | - 6,416 |
| 8 | 3,189 | - 2,648 | 2,001 | - 4,415 |
| 9 | 3,306 | 658 ^a | 1,957 | - 2,458 ^b |
| 10 | 3,415 | 4,073 | 1,907 | - 551 |
| 11 | 3,524 | 7,597 | 1,856 | 1,305 |
| 12 | 3,633 | 11,230 | 1,806 | 3,111 |
| 13 | 3,832 | 15,062 | 1,797 | 4,907 |
| 14 | 4,123 | 19,185 ^c | 1,824 | 6,731 ^d |

^{a,c} Undiscounted present values for five-year and ten-year payoff periods, respectively, as reported in Table 12.

^{b,d} Present values at 6% for five-year and ten-year payoff periods, respectively, as reported in Table 12.

In the case of the OA'4 MALE type of problem, the investment was expected to yield benefits for a forty-five year lifetime; therefore, the maximum length of this stream was set as forty-nine years (four-year period of study plus a possible forty-five year period of teaching). However an investor may be interested in the present value of his investment over a period any number of years in length. For example, what is the present value of an investment in a Bachelor of Education degree if the subject is able to teach for only five years after graduation? This problem presents an earnings stream nine years long (four years of study plus a five-year payoff period). Table 11 provides the answer for the OA'4 MALE: \$-2,458 if discounted at 6%. Just how this negative value may be interpreted and used for making a decision about the proposed investment forms part of the subject matter dealt with in the next chapter.

This study does not report the present values of earnings streams for every length of payoff period. The present values that are given are those calculated at consecutive five-year intervals, starting at the first five-year payoff period following the completion of the teacher training program, and continuing over the entire lifetime of the stream. The values for the fifty different subject types included in the study appear in Table 12 at the end of this chapter. As stated previously, discount rates used were 0%, 6%, 8%, and 12%; and the payoff periods were

expressed in multiples of five years.

Sub-Problem 4

What is the internal rate of return for each marginal earnings stream?

The solution of the equation of value to find the internal rate of return for a net earnings stream of given length has already been explained in Chapter II, and only a brief review of the process is required at this point. The internal rate of return is that discount rate which makes the algebraic sum of the net earnings stream equal zero. When the internal rate of return is used for discounting the earnings stream, what happens in effect is that the present value of the cost outflows is made exactly equal to the present value of the inflows. Thus the internal rate of return represents the rate of interest which is earned on the capital investment when the discounted costs of this investment are fully recovered from a future flow of earnings over a given period of time. Again, a fuller discussion of how this information helps to evaluate a proposed investment in teacher education is set aside for Chapter VI.

Some insight into the process of solving for the internal rate of return may be gained by examining the data in Table 11. Assume that the problem is to find the internal rate of return for the OA'4 MALE stream at the first five-year payoff period (at year nine in the stream). When this

stream is discounted to the ninth year at 0% its present value is positive at \$658. However, with a discount rate of 6%, the present value becomes negative at \$-2,458. Somewhere in between 0% and 6% there is a rate of discount which causes the present value of the stream to change signs; i.e. to go from positive, to zero, to negative. This discount rate is the internal rate of return. It may be estimated by interpolation in this problem, but it is more accurately solved by iteration. The interpolative solution is 1.27%; the iterative solution is 0.98%.

The internal rates of return for all subject categories are given in Table 12 in conjunction with the present values for every five-year payoff period. Negative rates where they occurred are indicated in the table by the minus sign, (-), but their magnitudes were not calculated. Because Table 12 is so expansive, it was found helpful to index it with an addendum placed immediately following. Finding the present values or the rates of return for any subject type is facilitated by first finding the *type number* for the subject in question, and then turning to that number in Table 12.

Table 12 may be considered to contain the main findings of the study. The interpretation and possible use of these findings is discussed in the next chapter.

TABLE 12

PRIVATE RETURNS TO TEACHER EDUCATION FOR DIFFERENT SUBJECT
TYPES BY LENGTH OF PAYOFF PERIOD

| Subject type | Length of payoff period (years) | Rate of return (%) | Present value of net earnings stream discounted at | | | |
|--|---|-----------------------------|---|------------|------------|------------|
| | | | 0% | 6% | 8% | 12% |
| #1 OA'3 male Ed'n held: 0 Age: under 25 Ed'n sought: 3 | 5 | (-) | \$ - 440 | \$ - 2,238 | \$ - 2,639 | \$ - 3,234 |
| | 10 | 11.7 | 10,269 | 3,416 | 1,974 | - 123 |
| | 15 | 15.0 | 21,042 | 7,694 | 5,160 | 1,675 |
| | 20 | 15.9 | 29,358 | 10,164 | 6,836 | 2,465 |
| | 25 | 16.2 | 36,462 | 11,734 | 7,804 | 2,844 |
| | 30 | 16.3 | 43,014 | 12,815 | 8,412 | 3,043 |
| | 35 | 16.4 | 50,735 | 13,761 | 8,894 | 3,173 |
| #2 OB'3 male Ed'n held: 0 Age: 25-34 Ed'n sought: 3 | 40 | 16.4 | 60,460 | 14,651 | 9,309 | 3,267 |
| | 45 | 16.4 | 72,107 | 15,450 | 9,647 | 3,331 |
| | 5 | (-) | - 22,228 | - 19,511 | - 18,729 | - 17,319 |
| | 10 | (-) | - 18,696 | - 17,719 | - 17,286 | - 16,370 |
| | 15 | (-) | - 11,837 | - 15,004 | - 15,266 | - 15,232 |
| | 20 | (-) | - 5,108 | - 13,025 | - 13,928 | - 14,608 |
| | 25 | 0.8 | 3,414 | - 11,156 | - 12,778 | - 14,157 |
| Ed'n held: 0 Age: 25-34 Ed'n sought: 3 | 30 | 2.4 | 13,939 | - 9,429 | - 11,809 | - 13,842 |
| | 35 | 3.4 | 25,988 | - 7,946 | - 11,051 | - 13,636 |
| | 40 | 4.0 | 38,118 | - 6,830 | - 10,531 | - 13,518 |

TABLE 12 (continued)

| Subject type | Length of payoff period (years) | Rate of return (%) | Present value of net earnings stream discounted at | | | |
|---|---------------------------------|--------------------|--|------------|------------|------------|
| | | | 0% | 6% | 8% | 12% |
| #3 OC'3 male Ed'n held: 0 Age: 35-44 Ed'n sought: 3 | 5 | (-) | \$ -27,801 | \$ -23,980 | \$ -22,907 | \$ -21,000 |
| | 10 | (-) | -25,159 | -22,687 | -21,879 | -20,341 |
| | 15 | (-) | -16,640 | -19,341 | -19,396 | -18,949 |
| | 20 | (-) | - 6,115 | -16,248 | -17,305 | -17,971 |
| | 25 | 1.1 | 5,934 | -13,593 | -15,668 | -17,331 |
| | 30 | 2.5 | 1,806 | -11,594 | -14,545 | -16,965 |
| #4 OD'3 male Ed'n held: 0 Age: 45-54 Ed'n sought: 3 | 5 | (-) | -26,395 | -23,086 | -22,138 | -20,431 |
| | 10 | (-) | -19,957 | -19,798 | -19,484 | -18,679 |
| | 15 | (-) | - 7,911 | -15,044 | -15,951 | -16,692 |
| | 20 | 1.0 | 4,219 | -11,464 | -13,527 | -15,555 |
| | | | | | | |
| | | | | | | |
| #5 OE'3 male Ed'n held: 0 Age: over 54 Ed'n sought: 3 | 5 | (-) | -20,466 | -18,425 | -17,808 | -16,661 |
| | 10 | (-) | -12,423 | -14,264 | -14,435 | -14,416 |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| #6 OA'3 female | 5 | 19.1 | 8,816 | 4,551 | 3,527 | 1,903 |
| | 10 | 29.3 | 32,069 | 16,773 | 13,486 | 8,601 |
| | 15 | 31.3 | 58,818 | 27,338 | 21,339 | 13,020 |
| | 20 | 31.7 | 85,643 | 35,256 | 26,699 | 15,535 |
| | | | | | | |
| | | | | | | |

TABLE 12 (continued)

| Subject type | Length of payoff period (years) | Rate of return (%) | Present value of net earnings stream discounted at | | | |
|----------------|---|-----------------------------|---|-----------|-----------|-----------|
| | | | 0% | 6% | 8% | 12% |
| Ed'n held: 0 | 25 | 31.8 | \$ 111,977 | \$ 41,068 | \$ 30,284 | \$ 16,938 |
| Age: under 25 | 30 | 31.8 | 137,559 | 45,286 | 32,654 | 17,711 |
| Ed'n sought: 3 | 35 | 31.8 | 162,624 | 48,375 | 34,234 | 18,141 |
| | 40 | 31.8 | 187,287 | 50,645 | 35,292 | 18,381 |
| | 45 | 31.8 | 211,563 | 52,315 | 36,000 | 18,514 |
| #7 | 5 | 7.1 | 3,745 | 454 | - 311 | - 1,492 |
| OB'3 female | 10 | 20.5 | 26,383 | 12,335 | 9,365 | 5,009 |
| | 15 | 23.3 | 52,410 | 22,622 | 17,013 | 9,315 |
| Ed'n held: 0 | 20 | 24.1 | 77,745 | 30,104 | 22,079 | 11,692 |
| Age: 25-34 | 25 | 24.3 | 102,649 | 35,599 | 25,468 | 13,018 |
| Ed'n sought: 3 | 30 | 24.4 | 127,150 | 39,638 | 27,737 | 13,758 |
| | 35 | 24.4 | 151,346 | 42,618 | 29,261 | 14,173 |
| | 40 | 24.4 | 175,526 | 44,844 | 30,298 | 14,408 |
| #8 | 5 | 5.7 | 2,945 | - 102 | - 807 | - 1,890 |
| OC'3 female | 10 | 19.3 | 24,193 | 11,045 | 8,269 | 4,207 |
| | 15 | 22.3 | 49,094 | 20,884 | 15,584 | 8,324 |
| Ed'n held: 0 | 20 | 23.1 | 73,595 | 28,118 | 20,483 | 10,623 |
| Age: 35-44 | 25 | 23.4 | 97,791 | 33,455 | 23,774 | 11,910 |
| Ed'n sought: 3 | 30 | 23.4 | 121,971 | 37,440 | 26,012 | 12,640 |

TABLE 12 (continued)

| Subject type | Length of payoff period (years) | Rate of return (%) | Present value of net earnings stream discounted at | | | |
|----------------|---|-----------------------------|---|------------|------------|------------|
| | | | 0% | 6% | 8% | 12% |
| #9 | 5 | 1.8 | \$ 971 | \$ - 1,662 | \$ - 2,258 | \$ - 3,157 |
| OD'3 female | 10 | 16.5 | 21,385 | 9,043 | 6,457 | 2,695 |
| Ed'n held: 0 | 15 | 19.9 | 45,578 | 18,560 | 13,561 | 6,693 |
| Age: 45-54 | 20 | 20.9 | 69,758 | 25,737 | 18,393 | 8,960 |
| Ed'n sought: 3 | | | | | | |
| #10 | 5 | (-) | - 222 | - 2,600 | - 3,129 | - 3,916 |
| OE'3 female | 10 | 15.0 | 19,871 | 7,930 | 5,441 | 1,838 |
| Ed'n held: 0 | | | | | | |
| Age: over 54 | | | | | | |
| Ed'n sought: 3 | | | | | | |
| #11 | 5 | 1.0 | 658 | - 2,458 | - 3,118 | - 4,062 |
| OA'4 male | 10 | 13.1 | 19,185 | 6,731 | 4,230 | 3,705 |
| Ed'n held: 0 | 15 | 16.4 | 40,671 | 14,753 | 10,086 | 3,887 |
| Age: under 25 | 20 | 17.4 | 59,961 | 20,136 | 13,667 | 5,509 |
| Ed'n sought: 4 | 25 | 17.7 | 78,304 | 23,956 | 15,979 | 6,381 |
| | 30 | 17.9 | 96,252 | 26,746 | 17,516 | 6,865 |
| | 35 | 17.9 | 115,734 | 29,004 | 18,649 | 7,161 |
| | 40 | 18.0 | 137,219 | 30,865 | 19,500 | 7,347 |
| | 45 | 18.0 | 160,467 | 32,372 | 20,127 | 7,461 |

TABLE 12 (continued)

| Subject type | Length of payoff period (years) | Rate of return (%) | Present value of net earnings stream discounted at | 0% | 6% | 8% | 12% |
|----------------|---------------------------------|--------------------|--|---------|------------|------------|------------|
| #12 | 5 | (-) | \$ | -22,995 | \$ -20,835 | \$ -20,142 | \$ -18,819 |
| OB'4 male | 10 | (-) | | -10,715 | -14,817 | -15,348 | -15,733 |
| | 15 | 2.1 | | 7,237 | -8,128 | -10,468 | -13,085 |
| Ed'n held: 0 | 20 | 4.9 | | 25,570 | -3,035 | -7,086 | -11,557 |
| Age: 25-34 | 25 | 6.3 | | 45,853 | 1,176 | -4,539 | -10,598 |
| Ed'n sought: 4 | 30 | 7.2 | | 68,138 | 4,634 | -2,634 | -10,000 |
| | 35 | 7.6 | | 91,628 | 7,363 | -1,264 | -9,641 |
| | 40 | 7.9 | | 115,118 | 9,403 | -332 | -9,437 |
| #13 | 5 | (-) | | -28,924 | -25,515 | -24,498 | -22,629 |
| OC'4 male | 10 | (-) | | -17,055 | -19,731 | -19,899 | -19,680 |
| | 15 | 0.8 | | 3,079 | -12,252 | -14,448 | -16,727 |
| Ed'n held: 0 | 20 | 4.1 | | 25,364 | -6,060 | -10,336 | -14,869 |
| Age: 35-44 | 25 | 5.7 | | 48,854 | -1,172 | -7,378 | -13,754 |
| Ed'n sought: 4 | 30 | 6.5 | | 72,344 | 2,480 | -5,365 | -13,121 |
| #14 | 5 | (-) | | -26,873 | -24,239 | -23,406 | -21,827 |
| OD'4 male | 10 | (-) | | -11,052 | -16,488 | -17,231 | -17,854 |
| Ed'n held: 0 | 15 | 2.9 | | 12,289 | -7,796 | -10,892 | -14,415 |
| Age: 45-54 | 20 | 5.6 | | 35,779 | -1,255 | -6,545 | -12,449 |
| Ed'n sought: 4 | | | | | | | |

TABLE 12 (continued)

| Subject type | Length of payoff period (years) | Rate of return (%) | Present value of net earnings stream discounted at | 0% | 6% | 8% | 12% |
|----------------|---|-----------------------------|---|---------|------------|------------|------------|
| #15 | 5 | (-) | \$ | -20,463 | \$ -19,293 | \$ -18,835 | \$ -17,884 |
| OE'4 male | 10 | (-) | | - 3,437 | -10,918 | -12,155 | -13,574 |
| Ed'n held: 0 | | | | | | | |
| Age: over 54 | | | | | | | |
| Ed'n sought: 4 | | | | | | | |
| #16 | 5 | 16.8 | | 12,015 | 5,574 | 4,098 | 1,833 |
| OA'4 female | 10 | 26.3 | | 43,972 | 21,410 | 16,759 | 10,040 |
| | 15 | 28.3 | | 81,953 | 35,556 | 27,078 | 15,638 |
| Ed'n held: 0 | 20 | 28.8 | | 120,105 | 46,180 | 34,139 | 18,833 |
| Age: under 25 | 25 | 29.0 | | 157,647 | 53,996 | 38,869 | 20,617 |
| Ed'n sought: 4 | 30 | 29.0 | | 194,459 | 59,722 | 42,026 | 21,610 |
| | 35 | 29.0 | | 230,803 | 63,945 | 44,146 | 22,164 |
| | 40 | 29.0 | | 266,746 | 67,067 | 45,574 | 22,479 |
| | 45 | 29.0 | | 302,333 | 69,376 | 46,535 | 22,654 |
| #17 | 5 | 8.2 | | 6,694 | 1,330 | 136 | - 1,652 |
| OB'4 female | 10 | 19.9 | | 38,212 | 16,940 | 12,613 | 6,434 |
| | 15 | 22.6 | | 75,301 | 30,761 | 22,697 | 11,906 |
| Ed'n held: 0 | 20 | 23.3 | | 111,895 | 40,953 | 29,471 | 14,970 |
| Age: 25-34 | 25 | 23.5 | | 148,079 | 48,484 | 34,029 | 16,690 |
| Ed'n sought: 4 | 30 | 23.6 | | 183,859 | 54,049 | 37,096 | 17,655 |
| | 35 | 23.6 | | 219,399 | 58,178 | 39,169 | 18,198 |
| | 40 | 23.6 | | 254,939 | 61,264 | 40,580 | 18,507 |

TABLE 12 (continued)

| Subject type | Length of payoff period (years) | Rate of return (%) | Present value of net earnings stream discounted at | 0% | 6% | 8% | 12% |
|----------------|---------------------------------|--------------------|--|---------|---------|---------|--------|
| #18 | 5 | 7.1 | \$ | 5,636 | \$ 620 | \$ - | 2,144 |
| OC'4 female | 10 | 18.9 | | 35,766 | 15,535 | 11,430 | 5,579 |
| | 15 | 21.8 | | 71,801 | 28,960 | 21,225 | 10,893 |
| Ed'n held: 0 | 20 | 22.5 | | 107,581 | 38,926 | 27,847 | 13,890 |
| Age: 35-44 | 25 | 22.8 | | 143,121 | 46,321 | 32,323 | 15,578 |
| Ed'n sought: 4 | 30 | 22.9 | | 178,661 | 51,846 | 35,369 | 16,535 |
| #19 | 5 | 4.2 | | 3,481 | - 1,046 | - 2,031 | 3,476 |
| OD'4 female | 10 | 16.8 | | 32,797 | 13,462 | 9,563 | 4,034 |
| Ed'n held: 0 | 15 | 20.0 | | 68,188 | 26,644 | 19,179 | 9,251 |
| Age: 45-54 | 20 | 20.9 | | 103,728 | 36,540 | 25,755 | 12,226 |
| Ed'n sought: 4 | | | | | | | |
| #20 | 5 | 2.6 | | 2,191 | - 2,042 | - 2,951 | 4,270 |
| OE'4 female | 10 | 15.7 | | 31,267 | 12,342 | 8,542 | 3,173 |
| Ed'n held: 0 | | | | | | | |
| Age: over 54 | | | | | | | |
| Ed'n sought: 4 | | | | | | | |
| #21 | 5 | (-) | | - 2,551 | - 2,813 | - 2,872 | 2,957 |
| IA1 | 10 | 5.3 | | 1,916 | - 197 | - 665 | 1,370 |
| Ed'n held: 1 | 15 | 11.1 | | 7,201 | 2,148 | 1,145 | 275 |
| | 20 | 13.0 | | 12,486 | 3,901 | 2,376 | 347 |

TABLE 12 (continued)

| Subject type | Length of payoff period (years) | Rate of return (%) | Present value of net earnings stream discounted at | 0% | 6% | 8% | 12% |
|----------------|---------------------------------|--------------------|--|---------|----------|----------|---------|
| Exp'ce: 0-2 | 25 | 13.7 | \$ | 17,771 | \$ 5,211 | \$ 3,215 | \$ 699 |
| Ed'n sought: 1 | 30 | 14.1 | | 23,056 | 6,190 | 3,785 | 899 |
| | 35 | 14.2 | | 28,341 | 6,921 | 4,174 | 1,013 |
| | 40 | 14.3 | | 33,626 | 7,467 | 4,438 | 1,077 |
| #22 | 5 | (-) | | - 5,179 | - 5,684 | - 5,777 | - 5,887 |
| IA2 | 10 | 4.9 | | 3,942 | - 636 | - 1,597 | - 2,984 |
| | 15 | 10.3 | | 14,522 | 3,794 | 1,758 | - 1,026 |
| Ed'n held: 1 | 20 | 12.1 | | 25,102 | 7,104 | 4,042 | 85 |
| Exp'ce: 0-2 | 25 | 12.9 | | 35,682 | 9,577 | 5,596 | 715 |
| Ed'n sought: 2 | 30 | 13.2 | | 46,262 | 11,426 | 6,653 | 1,073 |
| | 35 | 13.4 | | 56,842 | 12,807 | 7,373 | 1,276 |
| | 40 | 13.5 | | 67,422 | 13,839 | 7,863 | 1,391 |
| #23 | 5 | (-) | | - 4,477 | - 6,228 | - 6,585 | - 7,071 |
| IA3 | 10 | 9.7 | | 14,625 | 3,767 | 1,546 | - 1,618 |
| | 15 | 14.0 | | 36,565 | 12,433 | 7,988 | 2,007 |
| Ed'n held: 1 | 20 | 15.4 | | 58,505 | 18,909 | 12,372 | 4,064 |
| Exp'ce: 0-2 | 25 | 15.9 | | 80,445 | 23,748 | 15,356 | 5,231 |
| Ed'n sought: 3 | 30 | 16.2 | | 102,385 | 27,364 | 17,387 | 5,894 |
| | 35 | 16.3 | | 124,325 | 30,066 | 18,769 | 6,270 |
| | 40 | 16.3 | | 146,265 | 32,086 | 19,710 | 6,483 |

TABLE 12 (continued)

| Subject type | Length of payoff period (years) | Rate of return (%) | Present value of net earnings stream discounted at | | | |
|----------------|---------------------------------|--------------------|--|--------|--------|-------|
| | | | 0% | 6% | 8% | 12% |
| #24 | 5 | (-) | \$ - | \$ - | \$ - | \$ - |
| IBI | 10 | 6.2 | 2,506 | 2,972 | 3,051 | 3,169 |
| | 15 | 11.3 | 7,791 | 67 | 479 | 1,306 |
| | 20 | 13.1 | 13,076 | 2,412 | 1,331 | 1,210 |
| Ed'n held: 1 | 25 | 13.8 | 18,361 | 4,165 | 2,563 | 411 |
| Exp'ce: 3-5 | 30 | 14.1 | 23,646 | 5,475 | 3,401 | 763 |
| Ed'n sought: 1 | 35 | 14.2 | 28,931 | 6,453 | 3,972 | 963 |
| | 40 | 14.3 | 34,216 | 7,185 | 4,360 | 1,077 |
| | | | | 7,731 | 4,624 | 1,141 |
| #25 | 5 | (-) | 5,271 | - | - | - |
| IB2 | 10 | 5.7 | 5,068 | - | - | - |
| | 15 | 10.5 | 15,648 | 4,242 | 2,053 | - |
| | 20 | 12.2 | 26,228 | 7,552 | 4,336 | 143 |
| Ed'n held: 1 | 25 | 12.9 | 36,808 | 10,026 | 5,890 | 773 |
| Exp'ce: 3-5 | 30 | 13.2 | 47,388 | 11,874 | 6,948 | 1,132 |
| Ed'n sought: 2 | 35 | 13.4 | 57,968 | 13,256 | 7,668 | 1,335 |
| | 40 | 13.5 | 68,548 | 14,288 | 8,158 | 1,450 |
| #26 | 5 | (-) | - | - | - | - |
| IB3 | 10 | 10.6 | 3,751 | 6,055 | 6,541 | 7,225 |
| | 15 | 14.4 | 17,535 | 5,161 | 2,604 | 1,066 |
| Ed'n held: 1 | 20 | 15.7 | 39,475 | 13,827 | 9,046 | 2,559 |
| | | | 61,415 | 20,303 | 13,430 | 4,616 |

TABLE 12 (continued)

| Subject type | Length of payoff period (years) | Rate or return (%) | Present value of net earnings stream discounted at | 0% | 6% | 8% | 12% |
|----------------|---|-----------------------------|---|-----------|-----------|-----------|----------|
| Exp'ce: 3-5 | 25 | 16.1 | \$ | \$ 83,355 | \$ 25,142 | \$ 16,414 | \$ 5,784 |
| Ed'n sought: 3 | 30 | 16.3 | | 105,295 | 28,757 | 18,445 | 6,446 |
| | 35 | 16.4 | | 127,235 | 31,460 | 19,827 | 6,822 |
| | 40 | 16.5 | | 149,175 | 33,479 | 20,768 | 7,035 |
| #27 | 5 | (-) | | - 2,054 | - 2,651 | - 2,796 | - 3,025 |
| IC1 | 10 | 7.5 | | 2,231 | 488 | - | - 1,095 |
| | 15 | 12.0 | | 8,516 | 2,833 | 1,673 | 0 |
| Ed'n held: 1 | 20 | 13.6 | | 13,801 | 4,586 | 2,905 | 621 |
| Exp'ce: 6-8 | 25 | 14.2 | | 19,086 | 5,895 | 3,744 | 975 |
| Ed'n sought: 1 | 30 | 14.5 | | 24,371 | 6,874 | 4,314 | 1,175 |
| | 35 | 14.6 | | 29,656 | 7,606 | 4,702 | 1,288 |
| | 40 | 14.7 | | 34,941 | 8,152 | 4,968 | 1,353 |
| #28 | 5 | (-) | | - 4,129 | - 5,386 | - 5,664 | - 6,070 |
| IC2 | 10 | 6.8 | | 6,451 | 542 | - | - 2,620 |
| | 15 | 11.0 | | 17,031 | 4,972 | 2,621 | 662 |
| Ed'n held: 1 | 20 | 12.6 | | 27,611 | 8,282 | 4,904 | 449 |
| Exp'ce: 6-8 | 25 | 13.2 | | 38,191 | 10,755 | 6,458 | 1,079 |
| Ed'n sought: 2 | 30 | 13.5 | | 48,771 | 12,604 | 7,516 | 1,437 |
| | 35 | 13.7 | | 59,351 | 13,985 | 8,235 | 1,640 |
| | 40 | 13.7 | | 69,931 | 15,017 | 8,725 | 1,755 |

TABLE 12 (continued)

| Subject type | Length of payoff period (years) | Rate of return (%) | Present value of net earnings stream discounted at | 0% | 6% | 8% | 12% |
|----------------|---------------------------------|--------------------|--|------------|------------|------------|------------|
| #29 | 5 | (-) | \$ | \$ - 1,009 | \$ - 4,526 | \$ - 5,306 | \$ - 6,460 |
| IC3 | 10 | 11.9 | | 20,931 | 7,071 | 4,160 | - 72 |
| | 15 | 15.2 | | 42,871 | 15,737 | 10,602 | 3,553 |
| Ed'n held: 1 | 20 | 16.3 | | 64,811 | 22,213 | 14,986 | 5,610 |
| Exp'ce: 6-8 | 25 | 16.7 | | 86,751 | 27,052 | 17,970 | 6,778 |
| Ed'n sought: 3 | 30 | 16.9 | | 108,691 | 30,668 | 20,001 | 7,440 |
| | 35 | 16.9 | | 130,631 | 33,371 | 21,383 | 7,816 |
| | 40 | 17.0 | | 152,571 | 35,390 | 22,324 | 8,029 |
| #30 | 5 | (-) | | - 1,683 | - 2,373 | - 2,544 | - 2,819 |
| ID1 | 10 | 8.4 | | 3,602 | 766 | 115 | - 889 |
| | 15 | 12.6 | | 8,887 | 3,111 | 1,925 | 206 |
| Ed'n held: 1 | 20 | 14.1 | | 14,172 | 4,864 | 3,157 | 827 |
| Exp'ce: 9-11 | 25 | 14.7 | | 19,457 | 6,174 | 3,996 | 1,181 |
| Ed'n sought: 1 | 30 | 14.9 | | 24,742 | 7,152 | 4,566 | 1,381 |
| | 35 | 15.1 | | 30,027 | 7,884 | 4,954 | 1,494 |
| #31 | 5 | (-) | | - 3,359 | - 4,845 | - 5,185 | - 5,698 |
| ID2 | 10 | 7.6 | | 7,221 | 1,083 | 255 | - 2,247 |
| | 15 | 11.6 | | 17,801 | 5,512 | 3,100 | - 2,289 |
| Ed'n held: 1 | 20 | 13.0 | | 28,381 | 8,823 | 5,383 | 822 |
| | 25 | 13.6 | | 38,961 | 11,297 | 6,937 | 1,452 |

TABLE 12 (continued)

| Subject type | Length of payoff period (years) | Rate of return (%) | Present value of net earnings stream discounted at | 0% | 6% | 8% | 12% |
|-----------------|---|-----------------------------|---|-----------|-----------|----------|----------|
| Exp'ce: 9-11 | 30 | 13.9 | \$ | \$ 49,541 | \$ 13,145 | \$ 7,995 | \$ 1,810 |
| Ed'n sought: 2 | 35 | 14.0 | | 60,121 | 14,526 | 8,715 | 2,013 |
| #32 | 5 | 1.0 | | 877 | - 3,223 | - 4,157 | - 5,570 |
| ID3 | 10 | 13.0 | | 22,827 | 8,374 | 5,308 | 819 |
| | 15 | 15.9 | | 44,767 | 17,040 | 11,751 | 4,444 |
| Ed'n held: 1 | 20 | 16.9 | | 66,707 | 23,516 | 16,135 | 6,501 |
| Exp'ce: 9-11 | 25 | 17.3 | | 88,647 | 28,355 | 19,119 | 7,668 |
| Ed'n sought: 3 | 30 | 17.5 | | 110,587 | 31,971 | 21,150 | 8,330 |
| | 35 | 17.6 | | 132,527 | 34,673 | 22,532 | 8,706 |
| #33 | 5 | (-) | | - 1,683 | - 2,373 | - 2,544 | - 2,819 |
| IE1 | 10 | 8.4 | | 3,602 | 766 | 115 | 889 |
| | 15 | 12.6 | | 8,887 | 3,111 | 1,925 | 206 |
| Ed'n held: 1 | 20 | 14.1 | | 14,172 | 4,864 | 3,157 | 828 |
| Exp'ce: 12-max. | 25 | 14.7 | | 19,457 | 6,174 | 3,996 | 1,181 |
| Ed'n sought: 1 | 30 | 14.9 | | 24,742 | 7,152 | 4,566 | 1,381 |
| | 35 | 15.1 | | 30,027 | 7,884 | 4,954 | 1,494 |
| #34 | 5 | (-) | | - 3,356 | - 4,842 | - 5,183 | - 5,696 |
| IE2 | 10 | 7.6 | | 7,224 | 1,086 | 253 | 2,245 |

TABLE 12 (continued)

| Subject type | Length of payoff period (years) | Rate of return (%) | Present value of net earnings stream discounted at | 0% | 6% | 8% | 12% |
|-----------------|---|-----------------------------|---|---------|----------|----------|----------|
| Ed'n held: 1 | 15 | 11.6 | \$ | 17,804 | \$ 5,515 | \$ 3,102 | \$ - 287 |
| Exp'ce: 12-max. | 20 | 13.0 | | 28,384 | 8,826 | 5,386 | 824 |
| Ed'n sought: 2 | 25 | 13.6 | | 38,964 | 11,299 | 6,940 | 1,454 |
| | 30 | 13.9 | | 49,544 | 13,147 | 7,997 | 1,812 |
| | 35 | 14.0 | | 60,124 | 14,529 | 8,717 | 2,015 |
| #35 | 5 | 1.2 | | 1,036 | - 3,106 | - 4,049 | - 5,477 |
| IE3 | 10 | 13.1 | | 22,976 | 8,491 | 5,416 | 911 |
| | 15 | 16.0 | | 44,916 | 17,157 | 11,858 | 4,536 |
| Ed'n held: 1 | 20 | 17.0 | | 66,856 | 23,633 | 16,243 | 6,593 |
| Exp'ce: 12-max. | 25 | 17.4 | | 88,796 | 28,472 | 19,227 | 7,760 |
| Ed'n sought: 3 | 30 | 17.6 | | 110,736 | 32,088 | 21,257 | 8,423 |
| | 35 | 17.6 | | 132,676 | 34,790 | 22,640 | 8,799 |
| #36 | 5 | (-) | | - 3,116 | - 3,327 | - 3,371 | - 3,430 |
| IIA1 | 10 | 1.8 | | 666 | - 1,119 | - 1,511 | - 2,094 |
| | 15 | 8.8 | | 5,961 | 1,231 | 303 | - 997 |
| Ed'n held: 2 | 20 | 11.0 | | 11,256 | 2,987 | 1,537 | 374 |
| Exp'ce: 0-2 | 25 | 12.0 | | 16,551 | 4,299 | 2,377 | 21 |
| Ed'n sought: 1 | 30 | 12.4 | | 21,846 | 5,279 | 2,949 | 180 |
| | 35 | 12.6 | | 27,141 | 6,012 | 3,338 | 294 |
| | 40 | 12.7 | | 32,436 | 6,560 | 3,602 | 358 |
| | 45 | 12.8 | | 37,731 | 6,969 | 3,783 | 395 |

TABLE 12 (continued)

| Subject type | Length of payoff period (years) | Rate of return (%) | Present value of net earnings stream discounted at | 0% | 6% | 8% | 12% |
|----------------|---------------------------------|--------------------|--|---------|--------|--------|-------|
| #37 IIA2 | 5 | (-) | \$ | \$ - | \$ - | \$ - | \$ - |
| | 10 | 9.7 | | 3,395 | 4,524 | 4,776 | 5,146 |
| | 15 | 14.7 | | 9,291 | 2,486 | 1,028 | 1,119 |
| | 20 | 16.2 | | 25,914 | 9,444 | 6,298 | 1,955 |
| Ed'n held: 2 | 25 | 16.8 | | 42,569 | 14,655 | 9,892 | 3,704 |
| Exp'ce: 0-2 | 30 | 17.0 | | 59,224 | 18,549 | 12,338 | 4,697 |
| Ed'n sought: 1 | 35 | 17.1 | | 75,879 | 21,459 | 14,003 | 5,260 |
| | 40 | 17.2 | | 92,534 | 23,633 | 15,136 | 5,579 |
| | 45 | 17.2 | | 109,189 | 25,258 | 15,908 | 5,760 |
| | | | | 125,844 | 26,472 | 16,433 | 5,863 |
| #38 IIB1 | 5 | (-) | | - | - | - | - |
| | 10 | 3.4 | | 3,549 | 3,811 | 3,866 | 3,942 |
| | 15 | 9.1 | | 1,505 | - | 1,342 | 2,117 |
| | 20 | 11.1 | | 6,800 | 1,524 | 471 | 1,020 |
| Ed'n held: 2 | 25 | 11.9 | | 12,095 | 3,280 | 1,705 | 397 |
| Exp'ce: 3-5 | 30 | 12.3 | | 17,390 | 4,592 | 2,545 | 44 |
| Ed'n sought; 1 | 35 | 12.5 | | 22,685 | 5,572 | 3,117 | 157 |
| | 40 | 12.6 | | 27,980 | 6,305 | 3,506 | 271 |
| | | | | 33,275 | 6,853 | 3,771 | 335 |
| #39 IIB2 | 5 | (-) | | - | - | - | - |
| | 10 | 11.5 | | 3,086 | 4,610 | 4,958 | 5,481 |
| | 15 | 15.5 | | 12,915 | 4,318 | 2,456 | 306 |
| | | | | 29,570 | 11,291 | 7,738 | 2,776 |

TABLE 12 (continued)

| Subject type | Length of payoff period (years) | Rate of return (%) | Present value of net earnings stream discounted at | | | |
|----------------|---|-----------------------------|---|-----------|-----------|----------|
| | | | 0% | 6% | 8% | 12% |
| Ed'n held: 2 | 20 | 16.8 | \$ 46,225 | \$ 16,502 | \$ 11,332 | \$ 4,525 |
| Exp'ce: 3-5 | 25 | 17.2 | 62,880 | 20,395 | 13,779 | 5,518 |
| Ed'n sought: 2 | 30 | 17.4 | 79,535 | 23,305 | 15,444 | 6,081 |
| | 35 | 17.5 | 96,190 | 25,479 | 16,577 | 6,400 |
| | 40 | 17.6 | 112,845 | 27,104 | 17,348 | 6,581 |
| #40 | 5 | (-) | - | - | - | - |
| IIC1 | 10 | 4.6 | 2,163 | 3,644 | 3,763 | 3,946 |
| | 15 | 9.5 | 7,458 | - | - | - |
| | 20 | 11.3 | 12,753 | 1,851 | 1,714 | - |
| Ed'n held: 2 | 25 | 12.1 | 18,048 | 3,607 | 1,949 | - |
| Exp'ce: 6-8 | 30 | 12.5 | 23,343 | 4,919 | 2,789 | 62 |
| Ed'n sought: 1 | 35 | 12.7 | 28,638 | 5,900 | 3,360 | 262 |
| | 40 | 12.8 | 33,933 | 6,632 | 3,749 | 376 |
| | | | | 7,180 | 4,014 | 441 |
| #41 | 5 | (-) | - | - | - | - |
| IIC2 | 10 | 13.3 | 15,850 | 3,200 | 3,767 | 4,650 |
| | 15 | 16.6 | 32,505 | 6,132 | 3,993 | 781 |
| Ed'n held: 2 | 20 | 17.7 | 49,160 | 13,105 | 9,275 | 3,863 |
| Exp'ce: 6-8 | 25 | 18.1 | 65,815 | 18,316 | 12,869 | 5,612 |
| Ed'n sought: 2 | 30 | 18.3 | 82,470 | 22,210 | 15,316 | 6,605 |
| | 35 | 18.3 | 99,125 | 25,119 | 16,981 | 7,168 |
| | 40 | 18.4 | 115,780 | 27,294 | 18,114 | 7,487 |
| | | | | 28,918 | 18,885 | 7,668 |

TABLE 12 (continued)

| Subject type | Length of payoff period (years) | Rate of return (%) | Present value of net earnings stream discounted at | | | |
|-----------------|---------------------------------|---------------------|--|------------------------------|----------------------------|--------------------------------|
| | | | 0% | 6% | 8% | 12% |
| #42 IID1 | 5 10 15 | (-) 5.4 10.1 | \$ - 2,733 2,562 7,857 | \$ - 3,365 - 220 2,130 | \$ - 3,518 - 854 960 | \$ - 3,759 - 1,825 - 728 |
| Ed'n held: 2 | 20 | 11.8 | 13,152 | 3,886 | 2,194 | - 105 |
| Exp'ce: 9-11 | 25 | 12.5 | 18,447 | 5,198 | 3,034 | 248 |
| Ed'n sought: 1 | 30 | 12.8 | 23,742 | 6,178 | 3,606 | 449 |
| | 35 | 13.0 | 29,037 | 6,911 | 3,995 | 563 |
| #43 IID2 | 5 10 15 | 0.8 14.1 17.2 | 456 17,111 33,766 | - 2,349 6,983 13,956 | - 3,025 4,736 10,017 | - 4,094 1,338 4,420 |
| Ed'n held: 2 | 20 | 18.2 | 50,421 | 19,167 | 13,612 | 6,168 |
| Exp'ce: 9-11 | 25 | 18.6 | 67,076 | 23,061 | 16,058 | 7,161 |
| Ed'n sought: 2 | 30 | 18.7 | 83,731 | 25,971 | 17,723 | 7,724 |
| | 35 | 18.8 | 100,386 | 28,145 | 18,856 | 8,043 |
| #44 IIE1 | 5 10 15 | (-) 5.4 10.1 | - 2,730 2,565 7,860 | - 3,362 - 218 2,132 | - 3,515 - 815 962 | - 3,757 - 1,823 - 725 |
| Ed'n held: 2 | 20 | 11.8 | 13,155 | 3,888 | 2,197 | - 103 |
| Exp'ce: 12-max. | 25 | 12.5 | 18,450 | 5,201 | 3,037 | 251 |
| Ed'n sought: 1 | 30 | 12.8 | 23,745 | 6,181 | 3,608 | 451 |
| | 35 | 13.0 | 29,040 | 6,914 | 3,997 | 565 |

TABLE 12 (continued)

| Subject type | Length of payoff period (years) | Rate of return (%) | Present value of net earnings stream discounted at | 0% | 6% | 8% | 12% |
|-----------------|---|-----------------------------|---|---------|--------|--------|-------|
| #45 | 5 | 1.1 | \$ | 605 | \$ - | \$ - | \$ - |
| II E2 | 10 | 14.3 | | 17,260 | 2,225 | 2,908 | 3,990 |
| | 15 | 17.4 | | 33,915 | 7,107 | 4,852 | 1,441 |
| | 20 | 18.4 | | 50,570 | 14,080 | 10,133 | 4,523 |
| Ed'n held: 2 | 25 | 18.7 | | 67,225 | 19,291 | 13,728 | 6,272 |
| Exp'ce: 12-max. | 30 | 18.9 | | 83,880 | 23,184 | 16,174 | 7,264 |
| Ed'n sought: 2 | 35 | 18.9 | | 100,535 | 26,094 | 17,839 | 7,827 |
| | | | | | 28,268 | 18,972 | 8,147 |
| #46 | 5 | (-) | | - | - | - | - |
| III A1 | 10 | 14.8 | | 7,566 | 1,683 | 1,887 | 2,220 |
| | 15 | 19.5 | | 18,894 | 3,264 | 2,287 | 2,787 |
| | 20 | 20.8 | | 30,254 | 8,289 | 6,165 | 3,134 |
| Ed'n held: 3 | 25 | 21.2 | | 41,614 | 12,057 | 8,813 | 4,470 |
| Exp'ce: 0-2 | 30 | 21.3 | | 52,974 | 14,872 | 10,615 | 5,228 |
| Ed'n sought: 1 | 35 | 21.4 | | 64,334 | 16,976 | 11,842 | 5,658 |
| | 40 | 21.4 | | 75,694 | 18,548 | 12,676 | 5,902 |
| | 45 | 21.4 | | 87,054 | 19,723 | 13,244 | 6,040 |
| | | | | | 20,600 | 13,631 | 6,119 |
| #47 | 5 | (-) | | - | - | - | - |
| II B1 | 10 | 17.3 | | 358 | 1,426 | 1,696 | 2,139 |
| | 15 | 20.9 | | 10,351 | 4,895 | 3,648 | 1,725 |
| | 20 | 21.9 | | 21,711 | 9,936 | 7,539 | 4,079 |
| | | | | 33,071 | 13,704 | 10,187 | 5,415 |

TABLE 12 (continued)

| Subject type | Length of payoff period (years) | Rate of return (%) | Present value of net earnings stream discounted at | | | |
|----------------|---|-----------------------------|---|-----------|-----------|----------|
| | | | 0% | 6% | 8% | 12% |
| Ed'n held: 3 | 25 | 22.3 | \$ 44,431 | \$ 16,519 | \$ 11,989 | \$ 6,173 |
| Exp'ce: 3-5 | 30 | 22.4 | 55,791 | 18,623 | 13,215 | 6,603 |
| Ed'n sought: 1 | 35 | 22.4 | 67,151 | 20,195 | 14,050 | 6,847 |
| | 40 | 22.4 | 78,511 | 21,369 | 14,618 | 6,986 |
| #48 | 5 | 3.7 | 1,004 | 525 | 916 | 1,561 |
| IIIC1 | 10 | 19.3 | 12,364 | 6,222 | 4,801 | 2,588 |
| | 15 | 22.3 | 23,724 | 11,264 | 8,692 | 4,943 |
| Ed'n held: 3 | 20 | 23.1 | 35,084 | 15,031 | 11,339 | 6,278 |
| Exp'ce: 6-8 | 25 | 23.4 | 46,444 | 17,846 | 13,142 | 7,037 |
| Ed'n sought: 1 | 30 | 23.5 | 57,804 | 19,950 | 14,368 | 7,467 |
| | 35 | 23.5 | 69,164 | 21,522 | 15,203 | 7,711 |
| | 40 | 23.5 | 80,524 | 22,697 | 15,771 | 7,849 |
| #49 | 5 | 7.4 | 2,130 | 331 | 135 | 912 |
| IIID1 | 10 | 21.0 | 13,490 | 7,078 | 5,582 | 3,238 |
| | 15 | 23.7 | 24,850 | 12,119 | 9,473 | 5,592 |
| Ed'n held: 3 | 20 | 24.4 | 36,210 | 15,887 | 12,120 | 6,928 |
| Exp'ce: 9-11 | 25 | 24.6 | 47,570 | 18,702 | 13,923 | 7,686 |
| Ed'n sought: 1 | 30 | 24.7 | 58,930 | 20,806 | 15,149 | 8,116 |
| | 35 | 24.7 | 70,290 | 22,378 | 15,984 | 8,361 |

TABLE 12 (concluded)

| Subject type | Length of payoff period (years) | Rate of return (%) | Present value of net earnings stream discounted at | | | |
|-----------------|---|-----------------------------|---|--------|--------|-------|
| | | | 0% | 6% | 8% | 12% |
| #50 | 5 | 7.9 | \$ 2,276 | \$ 459 | \$ - | \$ - |
| IIIE1 | 10 | 21.4 | 13,636 | 7,206 | 5,704 | 3,351 |
| | 15 | 24.0 | 24,996 | 12,247 | 9,595 | 5,706 |
| Ed'n held: 3 | 20 | 24.7 | 36,356 | 16,015 | 12,243 | 7,042 |
| Exp'ce: 12-max. | 25 | 24.9 | 47,716 | 18,830 | 14,045 | 7,800 |
| Ed'n sought: 1 | 30 | 25.0 | 59,076 | 29,934 | 15,272 | 8,230 |
| | 35 | 25.0 | 70,436 | 22,506 | 16,107 | 8,474 |

ADDENDUM TO TABLE 12

INDEX

| Type number | Identifying subject label | Years of teacher education held | Years of experience or age for salary purposes | Years of teacher education sought |
|-------------------|---------------------------------|--|--|--|
| <u>AGE</u> | | | | |
| 1 | OA' 3 male | 0 | Under 25 | 3 |
| 2 | OB' 3 male | 0 | 25 - 34 | 3 |
| 3 | OC' 3 male | 0 | 35 - 44 | 3 |
| 4 | OD' 3 male | 0 | 45 - 54 | 3 |
| 5 | OE' 3 male | 0 | Over 54 | 3 |
| 6 | OA' 3 female | 0 | Under 25 | 3 |
| 7 | OB' 3 female | 0 | 25 - 34 | 3 |
| 8 | OC' 3 female | 0 | 35 - 44 | 3 |
| 9 | OD' 3 female | 0 | 45 - 54 | 3 |
| 10 | OE' 3 female | 0 | Over 54 | 3 |
| 11 | OA' 4 male | 0 | Under 25 | 4 |
| 12 | OB' 4 male | 0 | 25 - 34 | 4 |
| 13 | OC' 4 male | 0 | 35 - 44 | 4 |
| 14 | OD' 4 male | 0 | 45 - 54 | 4 |
| 15 | OE' 4 male | 0 | Over 54 | 4 |
| 16 | OA' 4 female | 0 | Under 25 | 4 |
| 17 | OB' 4 female | 0 | 25 - 34 | 4 |
| 18 | OC' 4 female | 0 | 35 - 44 | 4 |
| 19 | OD' 4 female | 0 | 45 - 54 | 4 |
| 20 | OE' 4 female | 0 | Over 54 | 4 |
| <u>EXPERIENCE</u> | | | | |
| 21 | IA1 | 1 | 0 - 2 | 1 |
| 22 | IA2 | 1 | 0 - 2 | 2 |
| 23 | IA3 | 1 | 0 - 2 | 3 |
| 24 | IB1 | 1 | 3 - 5 | 1 |
| 25 | IB2 | 1 | 3 - 5 | 2 |

ADDENDUM TO TABLE 12 (concluded)

| Type number | Identifying subject label | Years of teacher education held | Years of experience or age for salary purposes | Years of teacher education sought |
|----------------|---------------------------------|--|--|--|
| 26 | IB3 | 1 | 3 - 5 | 3 |
| 27 | IC1 | 1 | 6 - 8 | 1 |
| 28 | IC2 | 1 | 6 - 8 | 2 |
| 29 | IC3 | 1 | 6 - 8 | 3 |
| 30 | ID1 | 1 | 9 - 11 | 1 |
| 31 | ID2 | 1 | 9 - 11 | 2 |
| 32 | ID3 | 1 | 9 - 11 | 3 |
| 33 | IE1 | 1 | 12 - max. | 1 |
| 34 | IE2 | 1 | 12 - max. | 2 |
| 35 | IE3 | 1 | 12 - max. | 3 |
| 36 | IIA1 | 2 | 0 - 2 | 1 |
| 37 | IIA2 | 2 | 0 - 2 | 2 |
| 38 | IIB1 | 2 | 3 - 5 | 1 |
| 39 | IIB2 | 2 | 3 - 5 | 2 |
| 40 | IIC1 | 2 | 6 - 8 | 1 |
| 41 | IIC2 | 2 | 6 - 8 | 2 |
| 42 | IID1 | 2 | 9 - 11 | 1 |
| 43 | IID2 | 2 | 9 - 11 | 2 |
| 44 | IIE1 | 2 | 12 - max. | 1 |
| 45 | IIE2 | 2 | 12 - max. | 2 |
| 46 | IIIA1 | 3 | 0 - 2 | 1 |
| 47 | IIIB1 | 3 | 3 - 5 | 1 |
| 48 | IIIC1 | 3 | 6 - 8 | 1 |
| 49 | IIID1 | 3 | 9 - 11 | 1 |
| 50 | IIIE1 | 3 | 12 - max. | 1 |

CHAPTER VI

INTERPRETATION OF THE FINDINGS

This chapter examines how the present value and rate-of-return findings reported in Chapter V may be interpreted by individuals in making decisions about human capital investment in teacher education. The implications of the results for social policy are also dealt with.

Assessing the Attractiveness of Investment

The data displayed in Table 12 at the end of Chapter V were used to evaluate whether the investment opportunity presented for each of the fifty different subject types was either (1) economically attractive, or (2) economically unattractive. This assessment was made on the assumption of a reservation rate of 8%; that is, 8% was used as the basic discount rate, or the minimum acceptable rate of return.

If the cash flow analysis revealed an internal rate of return lower than the reservation rate of 8%, the investment was deemed to be economically unattractive. On the other hand, if the investment yielded 8% or better, it was deemed attractive. When alternative investment possibilities were compared, they were ranked in order of priority according to the magnitudes of the rates of return.

When the present value rule was applied, an investment in teacher education was judged to be economically attractive

if the present value of the anticipated benefits equalled or exceeded the present value of the costs. Thus if the value of a net earnings stream, discounted at the basic rate of 8%, turned out to be negative, the investment prospect was not considered a good one; if the present value was zero or positive, the proposed investment was economically attractive. As with rate of return, priorities were assigned according to the present values of the projects: the higher the present value, the more attractive the project.

Results for Type-0 Male Subjects

The type-0 label identifies subjects as possessing completed high school but no teacher training. The male members of this category bear subject type numbers 1 to 5, and 10 to 15 in Table 12. Table 13 below reproduces the present values and the internal rates of return associated with the lifetime marginal earnings streams for each of the ten sub-categories of the type-0 male subjects.

The most significant conclusion drawn from Table 13 was that investment in teacher education did not pay off for males in Alberta who commenced their teacher training after age twenty-five. After the first age interval, all the rates of return were below the reservation rate and all present values were negative, regardless of whether the investment was in three years or four years of teacher education. Subject number 12 approached payoff with a rate

TABLE 13

MARGINAL LIFETIME BENEFITS OF INITIAL TEACHER
TRAINING FOR TYPE-O^a MALE SUBJECTS IN
ALBERTA

| Subject number and type | Age at start of training | Rate of return | Present value of net earn- ings |
|----------------------------|-----------------------------|-------------------|---------------------------------------|
| <u>3 years training</u> | | | <u>At 8%</u> |
| 1. OA'3 | Under 25 | 16.4% | \$ 9,647 |
| 2. OB'3 | 25 - 34 | 4.0 | -10,531 |
| 3. OC'3 | 35 - 44 | 2.5 | -14,545 |
| 4. OD'3 | 45 - 54 | 1.0 | -13,527 |
| 5. OE'3 | Over 54 | (-) | -14,435 |
| <u>4 years training</u> | | | |
| 11. OA'4 | Under 25 | 18.0 | 20,127 |
| 12. OB'4 | 25 - 34 | 7.9 | - 332 |
| 13. OC'4 | 35 - 44 | 6.5 | - 5,365 |
| 14. OD'4 | 45 - 54 | 5.6 | - 6,545 |
| 15. OE'4 | Over 54 | (-) | -12,155 |

^aSubjects with completed high school but no teacher training.

of return of 7.9% and a present value of \$-332. In this case, a lower reservation rate of, say, 6% would have made the investment prospect profitable; so there may be some merit in considering taking a Bachelor of Education degree after age twenty-five, provided however, that at least twenty-five years of teaching service follow (see Table 12).

For the age interval "under 25", age eighteen was established as the time when the subject would enter university to take either three years (case #1, OA'3), or four years (case #11, OA'4) of training. In either case, the investment was analysed as being financially attractive. Three years of teacher education showed a rate of return of 16.4% and a present value of \$9,647. The corresponding figures for the Bachelor of Education degree were 18.0% and \$20,127. Clearly, acquiring the degree was the more attractive investment choice. Data in Table 12 showed, moreover, that both investments paid off after only ten years of teaching service and that the profitability increased with the length of the payoff period.

On the basis of the evidence, the prospective type-0 teacher trainee is best advised to enter the Faculty of Education at as early an age as possible, at least under age twenty-five, and to complete the degree requirements in preference to taking just three years. The completion of the degree is desirable on other grounds as well since three-year certification is interim under existing

regulations, and the teacher eventually has to obtain the fourth year of training for permanent certification. The marginal differential between the present values for three years and four years of training is so large that borrowing funds to finance the fourth year is recommendable if financial difficulties are encountered. Moreover, compared with three years of training, the degreed candidate begins to enjoy an immediate salary differential of about \$1200 per year based on 1968-69 rates of salary (see Table 5). On financial grounds from the trainee's point of view, a strong case can be made for dropping the existing three-year minimum teacher training requirement in Alberta, and making the four-year Bachelor of Education degree a prerequisite for certification.

The additional data in Table 12 for type-0 male subjects showed that the above conclusions were not altered substantially if the higher 12% reservation rate or the lower 6% were used for evaluating the investments. In only one case did the investment have to be reclassified from unattractive to attractive, and this occurred for the previously-noted marginal case, OB'4, when the 6% rate was applied. The economic status of each investment situation remained unaffected by using the higher 12% rate. The range of investment problems encountered in the type-0 male category was not sensitive to changes in the minimum acceptable rate of return.

Results for Type-0 Female Subjects

Table 14 contains a summary of the present values and rates of return calculated for lifetime marginal earnings streams for type-0 female subjects taking three or four years of teacher training. The results were almost in complete contrast with the results obtained for males. Teacher education for females was found to be an economically sound investment at all ages. The payoff period data in Table 12 showed, in addition, that profitability occurred rather quickly: within five years for cases OA'3, OA'4, and OB'4, and within ten years for the remaining seven cases. Females would find it attractive to obtain a Bachelor of Education degree even after age fifty-four. In contrast, the investments for men were unattractive unless training was taken prior to age twenty-five. The difference in the results between males and females was attributable to the combined effects of two factors. First, the opportunity costs for females were much lower than for males. Females forego less income by going to university. Secondly, female teachers enjoyed wage parity with men receiving equal pay for equal qualifications and experience. From a financial point of view, teacher education must rank very high as an investment opportunity for females in Alberta.

All rates of return on the lifetime earnings streams for females were found to be relatively high, exceeding

TABLE 14

MARGINAL LIFETIME BENEFITS OF INITIAL TEACHER TRAINING
FOR TYPE-O^a FEMALE SUBJECTS IN ALBERTA

| Subject number and type | Age at start of training | Rate of return | Present value of net earnings |
|----------------------------|-----------------------------|-------------------|----------------------------------|
| <u>3 years training</u> | | | <u>At 8%</u> |
| 6. OA'3 | Under 25 | 31.8% | \$ 36,000 |
| 7. OB'3 | 25 - 34 | 24.4 | 30,298 |
| 8. OC'3 | 35 - 44 | 23.4 | 29,012 |
| 9. OD'3 | 45 - 54 | 20.9 | 18,393 |
| 10. OE'3 | Over 54 | 15.0 | 5,441 |
| <u>4 years training</u> | | | |
| 16. OA'4 | Under 25 | 29.0 | 46,535 |
| 17. OB'4 | 25 - 34 | 23.6 | 40,580 |
| 18. OC'4 | 35 - 44 | 22.9 | 35,369 |
| 19. OD'4 | 45 - 54 | 20.9 | 25,755 |
| 20. OE'4 | Over 54 | 15.7 | 8,542 |

^aSubjects with completed high school but no teacher training.

20% in most cases. The highest marginal benefits accrued to those subjects who commenced their teacher training earliest, and declined with increase in the age interval.

When the data in Table 14 were examined to determine which was the more attractive investment choice for females -- a three-year program or a four-year program -- apparently conflicting evidence was found. The rates of return for the three-year program were higher than for the four-year program, with the exception of case OE'. Were internal rates of return alone used to decide attractiveness of investment choice, the three-year program would receive priority. However, the present values indicated that obtaining four years of education was the preferable choice since the discounted values of the lifetime earnings streams under this alternative were much higher. The higher rates of return for the three-year program indicated that for these problems the capital costs were more efficiently invested in relation to returns than was true for the four-year program. On the other hand, the present value measures showed that the four-year program was a bigger investment project which in the end yielded bigger absolute returns. For this reason present value is probably the better measure to use for evaluating the preferability of choices. This point of view has been expressed by others such as Wilkinson (1966) and Stager (1968, p. 56). They both note that present value analysis and rate-of-return analysis do not always lead to the same

ranking of choices or to identical investment decisions. Schultz' (1967) comment on this apparent discrepancy is most clarifying: "The alleged advantages of present value estimates over internal rate estimates are questionable in theory and in practice; each has its particular advantage (p. 308)."

The best rule to follow in cost-benefit analysis appears to be, therefore, to use both types of analysis rather than to use one to the exclusion of the other. The end result of the dual analysis is more comprehensive information. Thus for the type-0 female investment problems, the dual results revealed that the more efficient investment was the three-year program, but that four years of training paid back higher absolute returns. The present value results were used to rate the completion of the Bachelor of Education degree as the economically more attractive choice.

The present value comparison between three and four years of teacher training made it evident that females gained sizeable economic advantages by completing the degree program over the three-year program, and that these advantages increased the younger the subject and the longer the payoff period. In sum, the payoff on investment in teacher education by females was found to vary directly as the amount of training and length of payoff period, and inversely as age.

*An Observation on Present Value and Rate-of-Return**Results*

In the process of interpreting the findings for the first twenty subject types in the study, an interesting observation was made with respect to the sensitivity of the rate of return and the present value to the length of the marginal earnings stream. When the rate of return column in Table 12 was scanned for the first twenty subjects, it was noted that the rates of return for any problem reached a plateau very quickly. The levelling-off occurred at about the ten- or fifteen-year payoff period. After a certain point the rate remained constant even though both the length of the payoff period and the accumulating algebraic sum of the discounted cash flow were increasing.

When present values for the same problems were scanned, a similar levelling-off tendency at the ten- and fifteen-year marks was noted. However, the present values did appear to be more sensitive to the increasing length of the earnings streams; they continued to increase in magnitude, although at a decreasing rate, even after the matching rates of return had become constant or nearly constant.

The data for case OA'4 FEMALE is reproduced in Table 15 to illustrate these noted differences in the sensitivity of the two analyses to the length of the payoff period. The rate of return in Table 15 levelled off at fifteen years

TABLE 15

EFFECT OF PAYOFF PERIOD LENGTH ON RATE OF RETURN AND
PRESENT VALUE AS ILLUSTRATED BY CASE OA'4 FEMALE

| Length of payoff period (years) | Rate of return (%) | Present value at 8% | Marginal increase in present value |
|--|--------------------------|---------------------------|---|
| 5 | 16.8 | \$ 4,098 | |
| 10 | 26.3 | 16,759 | \$12,661 |
| 15 | 28.3 | 27,078 | 10,319 |
| 20 | 28.8 | 34,139 | 7,061 |
| 25 | 29.0 | 38,869 | 4,730 |
| 30 | 29.0 | 42,026 | 3,157 |
| 35 | 29.0 | 44,146 | 2,120 |
| 40 | 29.0 | 45,574 | 1,428 |
| 45 | 29.0 | 46,535 | 961 |

and became constant at 29.0% at twenty-five years. Present values, however, continued to increase over the entire length of the earnings stream. The size of the marginal increase at each five-year point in the earnings stream tended to become smaller the further the point moved away from the present. The discounting process over a twenty or thirty year period of time appeared to bring to convergence the present values of quite divergent sums. This converging effect was more severe the higher the rate of discount; this may be noted from the 12% column in Table 12 for problem OA'4 FEMALE and for any other problem.

The conclusion drawn from these observations was that both the internal rate of return and the present value were not sensitive to the entire length of the earnings stream, but that the present value was more sensitive than the internal rate of return. In general, this means that for studies using cash flow analysis, if the flows for the first ten or fifteen years can be accurately forecast, significant shifts or errors can occur in the next decades without substantially altering the results. The conclusion suggests also that little additional information is acquired by projecting earnings streams beyond a twenty-five or thirty year length. In this study a twenty-five year projection would have been adequate for analytical purposes, especially where the internal rate of return was concerned. The difference between the rates at twenty-five years and at

maximum length averaged only 0.46%, and between twenty years and maximum only 0.9%.

Results for Type-I Subjects

The type-I sub-category contained individuals who possessed one year of teacher training beyond high school and who had the option of seeking an additional one to three years of education. The findings for the investment problems pertaining to this group are recorded in Table 12 under subject type numbers 21 to 35 inclusive. As well, some of the findings are reproduced in Table 16 which follows. Table 16 shows the marginal benefits of additional teacher education for type-I subjects at the twenty-five year payoff period. The twenty-five year point was arbitrarily chosen as a suitable time horizon at which to ascertain the kind of returns which might be expected by type-I subjects. As observed in the previous section, returns reached a plateau at about this length of time period.

Table 16 revealed rates of return ranging from 12.9% to 17.4%, with the average rate for all fifteen cases being about 14.5%. The average return for one year of additional training for all experience levels was 14.2%, for two years of additional training 13.2%, and for three years 16.7%. Therefore, completing the degree year was the best investment option available to the type-I subject. The investment in one additional year of education turned out to be next most

TABLE 16

MARGINAL BENEFITS OF ADDITIONAL TEACHER TRAINING FOR
TYPE-I^a SUBJECTS AT THE TWENTY-FIVE YEAR
PAYOFF PERIOD

| Subject number and type | Rate of return (%) | Present value at 8% | Marginal increase in present value |
|----------------------------|--------------------------|---------------------------|---|
| 21. IA1 ^b | 13.7 | \$ 3,215 | \$ 3,215 |
| 22. IA2 | 12.9 | 5,596 | 2,381 |
| 23. IA3 | 15.9 | 15,356 | 9,760 |
| 24. IB1 | 13.8 | 3,401 | 3,401 |
| 25. IB2 | 12.9 | 5,890 | 2,489 |
| 26. IB3 | 16.1 | 16,445 | 10,555 |
| 27. IC1 | 14.2 | 3,744 | 3,744 |
| 28. IC2 | 13.2 | 6,458 | 2,714 |
| 29. IC3 | 16.7 | 17,970 | 11,512 |
| 30. ID1 | 14.7 | 3,996 | 3,996 |
| 31. ID2 | 13.6 | 6,937 | 2,941 |
| 32. ID3 | 17.3 | 19,119 | 12,182 |
| 33. IE1 | 14.7 | 3,996 | 3,996 |
| 34. IE2 | 13.6 | 6,940 | 2,944 |
| 35. IE3 | 17.4 | 19,227 | 12,287 |

^aSubjects with one year of teacher training beyond high school.

^bThe letters A, B, C, D, E in the subject label represent 0-2, 3-5, 6-8, 9-11, and 12-maximum years of teaching experience, respectively, that may be held at the commencement of additional training. The Arabic numerals indicate the additional years of teacher education sought.

attractive, and investment in two additional years least attractive.

The present values at the twenty-five year payoff period ranged from \$3,215 to \$19,227, discounted at the base rate, and averaged \$9,219 for the fifteen cases. The average present values across all experience levels for one, two, and three additional years of teacher education were \$3,670, \$6,364, and \$17,623, respectively. The absolute magnitudes of the present values ranked the options of one, two, or three years of additional education in a different order from that produced by the rate-of-return analysis. With present value, completing the degree was still the best investment choice as with rate of return, but completing two additional years was preferable to completing just one year.

Actually the differences in ranking produced by the two analyses did not arise from any inconsistencies in the two methods. If the last column in Table 16 is examined, it shows the reason why the rates of return for two additional years of training were lowest. The column indicates that the marginal gains at all levels of experience were higher when going from one year of training to two years than when going from two years to three years. The rates of return revealed these relative efficiencies of investment directly. The present values gave the same information only when the differences in the capital gains were compared as in the last column of Table 16. Perhaps the

following statement will serve to summarize and clarify this complication: for type-I problems, the present value analysis showed that the absolute values of the capital gains increased with each additional year of teacher training; the rate-of-return analysis revealed, however, that the *rate* of capital gain was highest for three years of additional training and lowest for two years.

The data in Table 16 also demonstrated that the profitability of any addition to teacher qualifications increased as experience held increased. This fact may be noted by referring to the increases either in rates of return or in the present values as the experience interval moves from A to E. The lowest marginal benefits would accrue to those subjects who held minimal years of experience at commencement of training; the highest benefits would be obtained by subjects with maximum experience. Thus if the effects of years of additional training and years of experience held were considered together, the generalization could be made for type-I subjects that the economic attractiveness of an investment in additional teacher education varied directly as years of training sought and years of teaching experience held at commencement of training. The maximum payoff would be achieved by persons on maximum experience who completed a degree. This phenomenon was explained by the fact that teacher salary differentials between any two levels of qualification increased as experience increased

(see Table 5).

The effects of the length of the payoff period and the rate of discount on marginal benefits were also examined. In the ensuing discussion, reference must again be made to Table 12 at the end of Chapter V where the following effects may be noted for cases 21 to 35:

1. In no cases was profitability shown at the five-year payoff period.

2. At the ten-year payoff period, the investments proved to be economically attractive for seven out of fifteen cases. (These were: IA3, IB3, IC3, ID1, ID3, IE1, and IE3).

3. Using the 6% reservation or discount rate at the ten-year payoff period, five additional cases became classified as economically attractive (IB1, IC1, IC2, ID2, IE2).

4. Using the 12% reservation or discount rate at the ten-year payoff period resulted in only two cases out of fifteen (ID3 and IE3) being classified as economically attractive.

5. At the basic 8% rate, all investment choices conceived for type-I subjects were economically attractive at the fifteen-year and later payoff periods. However, the increments to the present values decreased as the length of the payoff period increased.

These observations indicated that the length of the payoff period and the rate of discount were important determinants of economic attractiveness for the set of investment problems associated with type-I subjects. Particularly significant was the fact that the choice of discount rate or reservation rate for the shorter payoff periods was critical in determining whether particular investment choices were worthwhile or not. For type-0 female problems discussed earlier, the earnings differentials between years of training were so large that the choice of rates had almost no effect on the attractiveness decision. When the differentials become small, as with type-I problems, the analysis becomes more sensitive to the reservation and discount rates employed.

Results for Type-II Subjects

The interpretation of the results for type-II subjects follows the pattern adopted for the discussion of type-I findings in the previous section. Type-II subjects were defined as individuals who possessed two years of teacher training beyond high school, and who could seek an additional one or two years of education. The present values and rates of return for this group are found in Table 12 under subject numbers 36 to 45 inclusive. The returns at the twenty-five year payoff period are reproduced in Table 17 which follows.

As Table 17 reveals, internal rates of return for

TABLE 17

MARGINAL BENEFITS OF ADDITIONAL TEACHER TRAINING FOR
TYPE-II^a SUBJECTS AT THE TWENTY-FIVE YEAR
PAYOFF PERIOD

| Subject number and type | | Rate of return (%) | Present value at 8% |
|----------------------------|-------------------|--------------------------|------------------------|
| 36. | IIA1 ^b | 12.0 | \$ 2,377 |
| 37. | IIA2 | 16.8 | 12,338 |
| 38. | IIB1 | 11.9 | 2,545 |
| 39. | IIB2 | 17.2 | 13,779 |
| 40. | IIC1 | 12.1 | 2,789 |
| 41. | IIC2 | 18.1 | 15,316 |
| 42. | IID1 | 12.5 | 3,034 |
| 43. | IID2 | 18.6 | 16,058 |
| 44. | IIE1 | 12.5 | 3,037 |
| 45. | IIE2 | 18.7 | 16,174 |

^aSubjects with two years of teacher training beyond high school.

^bThe letters A, B, C, D, E in the subject label represents 0-2, 3-5, 6-8, 9-11, 12-maximum years of teaching experience, respectively, that may be held at the commencement of additional training. The Arabic numerals indicate the additional years of teacher education sought.

type-II subjects were found to range from 12.0% to 18.7% and to average 15.0% for the whole group. The average return for one year of additional training, all experience levels considered, was 12.2%, while the average return for completing the degree amounted to 17.9%. As was demonstrated before with type-I subjects, completing the degree year -- i.e., taking two additional years of training -- was clearly the superior alternative.

The present values in Table 17 ranged from \$2,377 to \$16,174, averaging \$8,745 for the whole group, \$2,756 for one year of additional training, and \$14,733 for completion of the degree. The present value estimates also indicated a considerable financial advantage for completion of the degree as compared to completion of one further year of study.

The data in Table 17 disclosed that the economic attractiveness of investment in teacher education increased as experience held at commencement of training increased. This same observation was made in connection with type-I subjects. The combined effects of further training and experience resulted in maximum payoff occurring for persons with maximum experience completing the degree. Least gain in the capitalized value of further teacher education was shown for subjects with minimal experience taking one further year of study.

The effects of the length of the payoff period and the rate of discount on marginal benefits were also examined

for type-II subjects. The following observations with respect to these factors were based on the data recorded in Table 12 (subject types 36 to 45) at the end of Chapter V.

1. In no cases was payoff achieved at the end of a five-year earning period.

2. Two years of additional training proved profitable for all cases if followed by at least ten years of teaching service.

3. One year of additional training became financially attractive only if followed by at least fifteen years of teaching. Therefore, payoff followed more quickly if the length of training period was increased, or in other words, if the degree was earned.

4. As with type-I subjects, the general statement could be made that additional investment in teacher education was economically attractive for all subjects in the type-II category providing a fifteen-year payoff period followed. However the marginal gains in the capitalized value of all investment choices declined with greater length of payoff period.

5. Using the lower 6% discount or reservation rate produced no change in the economic attractiveness of the type-II investment choices.

6. When the higher 12% discount or reservation rate was applied, the following effects were noted:

(a) With one exception, the attractiveness classification of investments involving the completion of a degree (two additional years of training) was unaffected. The exception was case IIB2 (#39), which required a fifteen-year payoff period for profitability as compared to a ten-year period at 6% or 8%.

(b) The payoff period length required for profitability if only one further year of study was sought was significantly increased, going from fifteen years at the lower rates to twenty-five years for cases IID1 and IIE1 (#'s 42 and 44), and to thirty years for cases IIA1, IIB1, and IIC1 (#'s 36, 38, and 40).

In summary, this set of problems was to some extent sensitive to the choice of discount or reservation rate. The results of the analysis were affected in six cases out of ten when the higher 12% rate was applied. However, the results were unaffected when the lower 6% rate was used. Again it was noted that the sensitivity increased as the size of the earnings differentials in the marginal earnings streams decreased. The differentials resulting from completion of a degree by type-II subjects were large compared to the differentials resulting from completing one additional year. In the former case, the discount rates could vary more widely without affecting the decisions respecting the attractiveness of the investment. In the latter case involving smaller differentials, the decisions

were altered by choosing higher discount rates.

Results for Type-III Subjects

Type-III subjects were defined as persons holding three years of teacher education beyond high school. An additional year of university would enable them to complete a Bachelor of Education degree. The investment opportunities associated with this group are represented in Table 12 at the end of Chapter V under case numbers 46 to 50 inclusive. As well, the rates of return and present values calculated for the twenty-five year payoff period are reproduced in Table 18 below.

As shown in Table 18, internal rates of return for type-III subjects ranged from 21.2% to 24.9%. The average rate of return for all five cases was 23.3% and this was higher than any of the average rates computed for type-I and type-II cases. Present values ranged from \$10,615 to \$14,045, averaging \$12,743 for the group. The pattern with respect to the influence of experience on marginal returns established in type-I and type-II problems was repeated for type-III cases. Marginal returns as indicated by both present value and rate-of-return measures increased as experience held at commencement of further study increased. Maximum returns were produced for people with maximum teaching experience returning to university to complete the last year of the degree program.

TABLE 18

MARGINAL BENEFITS OF ADDITIONAL TEACHER TRAINING FOR
TYPE-III^a SUBJECTS AT THE TWENTY-FIVE YEAR
PAYOFF PERIOD

| Subject number and type | Rate of return (%) | Present value at 8% |
|----------------------------|--------------------------|------------------------|
| 46. IIIA1 ^b | 21.2 | \$ 10,615 |
| 47. IIIB1 | 22.3 | 11,989 |
| 48. IIIC1 | 23.4 | 13,142 |
| 49. IIID1 | 24.6 | 13,923 |
| 50. IIIE1 | 24.9 | 14,045 |

^aSubjects with three years of teacher training beyond high school.

^bThe letters A, B, C, D, E in the subject label represent 0-2, 3-5, 6-8, 9-11, 12-maximum years of teaching experience, respectively, that may be held at the commencement of additional training. The Arabic numeral 1 indicates one additional year of teacher education sought.

An examination of Table 12 as to the effect of length of payoff period on profitability revealed that all investment choices proved profitable after ten years of teaching. Case IIIE2 approached profitability at the five-year period with a rate of return at that point of 7.9% and a present value of \$-12. The application of the 12% rate to the calculations did not change the results achieved at 8%. However, the lower 6% rate did make the last two cases, IIID1 and IIIE1, profitable within a shorter payoff period of five years.

Effect of Teacher Education Held on Returns

The effect of teacher education held by type-I, II, and III subjects at the commencement of further study on the internal rate of return was another aspect of the general research problem which was examined. The information contained in Table 19 shows the rates of return averaged over all experience categories at the twenty-five year payoff period. These rates demonstrated that, for all subject types, completing the entire degree program was the best educational investment possible regardless of whether one, two, or three years of teacher education were held. However, the rates also showed that the prospect of completing the degree was economically most attractive for the person who already held three years of education. The rate of return to be gained was 23.3% compared to returns of 17.9% for a person with two years

TABLE 19

EFFECT OF TEACHER EDUCATION HELD ON RATE OF
RETURN TO ADDITIONAL TEACHER EDUCATION

| Teacher education held at start of further study | Average rate of return at the twenty-five year payoff period resulting from the completion of an additional: | | |
|--|---|------------|------------|
| | 1 year | 2 years | 3 years |
| 1 year | 14.2% | 13.2% | 16.7% |
| 2 years | 12.2 | 17.9 | |
| 3 years | 23.3 | | |

of training, and 16.7% for a person with one year of training. As far as completing the Bachelor of Education degree was concerned, then, the person who stood to benefit most financially was the person who already held the highest qualifications.

Table 19 shows furthermore that if a person held one year of education, completing the second year of study was relatively more profitable with a return of 14.2% than completing the second and third year which returned 13.2%. Holding two years and completing the third resulted in the lowest return shown in the table, 12.2%. The evidence in Table 19 indicated, therefore, that Alberta 1968-69 salary scales were least favourable to teachers moving into the third-year level of qualification. The move yielded a rate of return lower than that found for the other categories. Some upward adjustments in rate of salary for teachers with three years of training appeared warranted. The comparatively high returns for completion of the fourth year of study suggested that salary schedules were slanted in favour of teachers with degrees. However, this may have been a reflection of deliberate social policy adopted by school boards and teachers to provide economic incentives for establishing the teaching degree as the minimum standard of professional preparation.

The Break-Even Point

One of the important items of information which may be derived from a cash flow analysis of investment in teacher education is the position of the break-even point in the marginal earnings stream. The break-even point is the point at which the cumulative discounted value of the earnings stream changes sign from negative to positive. It indicates to the investor the number of years of teaching service which must follow the period of study in order for the human capital investment to pay off or become profitable. The position of the break-even point is affected by two variables: (1) the size of the yearly marginal benefits, and (2) the time rate preference of the investor. If marginal benefits are large in relation to costs, the break-even point will occur relatively early in the earnings stream. Similarly, the lower the time rate preference of the individual -- say, 6% as opposed to 12% -- the sooner the break-even point will occur.

The location of the break-even point in all fifty marginal earnings streams analysed in the study may be interpolated for 0%, 6%, 8%, and 12% rates of discount by using the data recorded in Table 12 at the end of Chapter V. The internal rates of return in the same table would serve to give a crude interpolative estimate of the break-even point for other rates. For example, if 10% is accepted

as the minimum acceptable rate of return for an investment, the subject may examine the relevant section of Table 12, to see between what payoff periods the internal rate of return goes from less than 10% to more than 10%. When present value data are used, the subject simply has to find the first payoff period which is positive at the given rate of discount. Interpolation of present value data for the purposes of the study, however, was not necessary since the computer program gave the exact location in the net earnings streams where the discounted accumulated sums became positive. This information has been summarized for every subject type in Table 20 as years of teaching service required after study for the investment in teacher training to become profitable.

The data in Table 20 disclosed that with the exception of type-0 males -- who in many cases could not recover their investments within their working lifetimes -- all subjects could expect their investments in teacher education to pay off within a reasonable time horizon. At the basic rate of 8%, some of the investment situations paid off in four or five years; no investment required a longer payoff period than fifteen years to become profitable. As expected, the break-even points moved considerably further down the earnings streams when the higher 12% was used as the minimum acceptable return.

TABLE 20

YEARS OF TEACHING SERVICE REQUIRED FOR PROFITABILITY
OF INVESTMENT IN TEACHER EDUCATION

| Subject type | Break-even point in years of teaching service at discount rate of: | | | | Subject type | Break-even point in years of teaching service at discount rate of: | | | |
|----------------------|--|----------------|----|-----|-----------------|--|----|----|-----|
| | 0% | 6% | 8% | 12% | | 0% | 6% | 8% | 12% |
| <u>Male</u> | | | | | | | | | |
| 1. OA'3 ^a | 6 | 7 | 8 | 11 | 26. IB3 | 6 | 8 | 9 | 12 |
| 2. OB'3 | 24 | - ^b | - | - | 27. IC1 | 7 | 10 | 11 | 15 |
| 3. OC'3 | 23 | - | - | - | 28. IC2 | 7 | 10 | 11 | 18 |
| 4. OD'3 | 19 | - | - | - | 29. IC3 | 6 | 7 | 8 | 11 |
| 5. OE'3 | - | - | - | - | 30. ID1 | 7 | 9 | 10 | 14 |
| <u>Female</u> | | | | | | | | | |
| 6. OA'3 | 3 | 4 | 4 | 4 | 31. ID2 | 7 | 9 | 11 | 17 |
| 7. OB'3 | 4 | 5 | 6 | 7 | 32. ID3 | 5 | 7 | 7 | 10 |
| 8. OC'3 | 5 | 6 | 6 | 7 | 33. IE1 | 7 | 9 | 10 | 14 |
| 9. OD'3 | 5 | 6 | 7 | 8 | 34. IE2 | 7 | 9 | 11 | 17 |
| 10. OE'3 | 6 | 7 | 7 | 9 | 35. IE3 | 5 | 7 | 7 | 10 |
| <u>Male</u> | | | | | | | | | |
| 11. OA'4 | 5 | 7 | 8 | 10 | 36. IIA1 | 10 | 13 | 15 | 26 |
| 12. OB'4 | 12 | 24 | - | - | 37. IIA2 | 7 | 9 | 10 | 17 |
| 13. OC'4 | 15 | 27 | - | - | 38. IIB1 | 9 | 12 | 14 | 26 |
| 14. OD'4 | 13 | - | - | - | 39. IIB2 | 7 | 8 | 9 | 11 |
| 15. OE'4 | - | - | - | - | 40. IIC1 | 8 | 11 | 13 | 24 |
| <u>Female</u> | | | | | | | | | |
| 16. OA'4 | 3 | 4 | 4 | 5 | 41. IIC2 | 6 | 8 | 8 | 10 |
| 17. OB'4 | 4 | 5 | 5 | 6 | 42. IID1 | 8 | 11 | 13 | 22 |
| 18. OC'4 | 4 | 5 | 6 | 7 | 43. IID2 | 5 | 7 | 7 | 9 |
| 19. OD'4 | 5 | 6 | 6 | 8 | 44. IIE1 | 8 | 11 | 13 | 22 |
| 20. OE'4 | 5 | 6 | 7 | 8 | 45. IIE2 | 5 | 7 | 7 | 9 |
| 21. IA1 | 9 | 11 | 12 | 17 | 46. IIIA1 | 6 | 7 | 8 | 9 |
| 22. IA2 | 9 | 11 | 13 | 20 | 47. IIIB1 | 6 | 7 | 7 | 8 |
| 23. IA3 | 7 | 9 | 10 | 12 | 48. IIIC1 | 6 | 6 | 6 | 7 |
| 24. IB1 | 8 | 10 | 12 | 17 | 49. IIID1 | 5 | 5 | 6 | 6 |
| 25. IB2 | 8 | 11 | 12 | 20 | 50. IIIE1 | 4 | 5 | 6 | 6 |

^aSee Table I for variables represented by symbols in the subject labels.

^bThe negative sign (-) indicates that the investment does not prove profitable within the expected working lifetime of the subject.

Comparisons with Other Studies

Private Returns to Degrees in Education

In Chapter IV a summary was presented of findings by Wilkinson, Stager, Harvey, and Podoluk respecting private returns for teaching degrees and university degrees in Canada as revealed by data gathered during the 1961 Census. Bearing in mind the relevant limitations and qualifications associated with each study, it was possible to make comparisons of the results obtained by the four researchers with some of the results for Alberta teachers disclosed by this study. The specific findings that were compared consisted of the present values and rates of return calculated for the lifetime marginal earnings streams of type-0 male and female subjects who obtained a four-year Bachelor of Education degree immediately upon completion of high school. These values, as recorded for subjects types #11 and #16 in Table 12, were as follows:

| | <u>Present value</u> | | <u>Rate of</u> |
|-------------------------|----------------------|-----------|----------------|
| | <u>6%</u> | <u>8%</u> | <u>return</u> |
| B. Ed. degree (males) | \$32,372 | \$20,127 | 18.0% |
| B. Ed. degree (females) | 69,376 | 46,535 | 29.0 |

By comparison, Wilkinson (1966), using a discount rate of 8% and 1961 as the base year, estimated a present value of \$18,300 for a teaching degree for males in Canada. In terms of 1968 dollars Wilkinson's estimate would be

converted to approximately \$24,000, which exceeds somewhat the \$20,127 figure given above. However, Wilkinson included in the earnings flows part-time and summer earnings of \$725 per year. When the discounted value of these earnings were subtracted from \$24,000, the result was \$21,600. On this basis the capitalized value of a teaching degree for males in Canada as calculated by Wilkinson turned out to be so close to the estimates made in this study as to suggest that private returns to male teacher education in Alberta were about the same as returns averaged by all male teachers in Canada. This conclusion was corroborated by Harvey's (1967) calculation of a 17% rate of return for Canadian degreed male teachers which agrees with the 18.0% found in this study. In 1965, Podoluk reported a 19.7% return for a university degree for Canadian males. By comparison, Alberta and Canadian male teachers appeared to receive lower returns for education degrees. However, these conclusions must be accepted as suggestive and tentative only since the different adjustments, assumptions, and techniques employed from study to study make unqualified comparisons hazardous.

Some comparisons of returns for female teachers in Canada and Alberta were also made possible by the information available. Harvey estimated the rate of return for degreed female teachers in Canada to be 21%. The present study found the rate of return for Alberta female teachers to be 29.0%. Female teachers in Alberta, therefore, appeared to

earn higher returns than were earned by Canadian male or female teachers, or by male university graduates in Canada.

Because Harvey's study was specific to Quebec, and Stager's to Ontario, some interprovincial comparisons were available. At the degree level, Harvey found the rate of return for Protestant male teachers in Quebec to be 14%, and for Protestant female teachers 12%. The rates for Catholic teachers were considerably lower for both sexes. Stager computed a rate of return of 10.3% for male teachers in Ontario with a five-year teaching degree. The five-year training period plus the fact that Stager adjusted his data for mortality, labour force participation rates and for income tax would all tend to bias the Ontario returns downward. In all cases where comparisons could be made, the Quebec and Ontario returns were lower than those found for Alberta. Moreover, these returns were lower than figures reported for Canada as a whole.

Concurrent Studies

Two concurrent studies employing the same methodology and base year as this study were undertaken at the University of Alberta to measure private monetary returns to other kinds of educational programs. Wilson (1970) analysed the returns for males in baccalaureate programs in the Faculties of Arts, Science, and Engineering, and compared the results with returns to a teacher education program taken by males already

possessing an approved three-year degree. Wallace (1970) studied the private rates of return and present values for a special subsidized program designed to prepare both male and female secondary school teachers in the area of technical and vocational education. Both studies were delimited to the Alberta setting.

Wilson's male teacher subjects consisted of those individuals who chose to take one year of teacher training after first obtaining a three-year Bachelor of Arts or a Bachelor of Science degree. He found that the rates of return and the present values for this educational investment were practically the same as those obtained in this study. Table 21 contains some of the comparable results of both studies. The conclusion may be made from the data in Table 21 that the choice between the two program routes studied did not affect monetary returns. Male candidates could take a straight four-year Bachelor of Education program, or a B.A. or B. Sc. program followed by one year of teacher education, without encountering any differences in the net benefits to be gained.

The present values in Table 21 show that Wilson found investment in a three-year B.A. or B. Sc. program less attractive financially than either of the four-year teacher education routes. However, the returns computed in this study for three years of teacher education were much lower than the returns for the three-year arts or science degrees.

TABLE 21
COMPARISON OF FINDINGS FOR RETURNS TO BACCALAUREATE EDUCATION IN ALBERTA

| Wilson | | | | | Length of payoff period (yrs.) | Dibski | | | | | |
|--|--------------------|---|----------|----------|--------------------------------|--------------------|---|----------|----------|--|--|
| Age at which program started | Rate of return (%) | Present value of net earnings stream discounted at: | | | | Rate of return (%) | Present value of net earnings stream discounted at: | | | | |
| | | 0% | 6% | 8% | | | 0% | 6% | 8% | | |
| Three-year B.A. or B. Sc. plus one year of teacher education (males) | | | | | | | | | | | |
| 18 | 17.9 | \$151,044 | \$31,796 | \$19,884 | 43 | 18.0 | \$151,071 | \$31,815 | \$19,902 | | |
| 30 | 7.3 | 72,809 | 5,221 | -2,340 | 31 | 7.3 | 72,836 | 5,245 | -2,317 | | |
| 40 | 4.5 | 30,035 | -4,989 | -9,672 | 21 | 4.3 | 30,062 | -4,965 | -9,650 | | |
| Three-year B.A. or B. Sc. (males) | | | | | | | | | | | |
| 18 | 19.4 | 131,097 | 26,877 | 16,922 | 44 | 16.4 | 69,681 | 15,302 | 9,587 | | |
| 30 | 6.2 | 56,846 | 650 | -5,139 | 32 | 2.6 | 18,710 | -8,790 | -11,474 | | |
| 40 | 2.7 | 15,526 | -9,305 | -12,326 | 22 | (-) | -1,344 | -15,104 | -16,581 | | |
| Four-year B. Sc. in engineering (males) | | | | | | | | | | | |
| 18 | 21.1 | 161,707 | 37,757 | 24,896 | 43 | | | | | | |
| 30 | 8.9 | 83,184 | 11,161 | 2,665 | 31 | | | | | | |
| 40 | 6.1 | 39,415 | 311 | -5,247 | 21 | | | | | | |

The financial advantage of completing the education degree was again pointed up. As well, the comparison reinforced the contention stated earlier in this chapter that Alberta rates of salary for teachers in the three-year category of qualification must be relatively low to produce such low priority ratings for this level of training.

The returns to engineering education in Alberta were also studied by Wilson and some of the findings are included in Table 21. The engineering degree was found to be more attractive financially than any of the other education programs with which it was compared.

Wallace's study focused on a special four-year Bachelor of Education program designed to prepare secondary school teachers for vocational education. To be admitted to this program candidates had to hold trade training as verified by a Journeyman's Certificate for a designated trade, or they had to hold equivalent standing for a non-designated trade. Some experience in a trade or industry calling for the trade training held by the candidate was also required for admission. Approved candidates were granted credit for the first year of this special Bachelor of Education program, and upon completion of a year of study were certificated as teachers with two years of training. A special feature of the program was that candidates received subsidies for the first year of study in the form of remission of fees, bursaries from school boards, and subsistence

allowances from Canada Manpower. The amount of the subsidy varied depending upon the marital status of the candidate and upon the number of dependents he had. Wallace calculated an average subsidy of \$3,347 for a single person. He also reported that teachers who had taken this program were usually placed on the fifth or sixth increment of the salary scale when hired by a school board. Consequently, the cash inflows and outflows prevailing for these teachers differed markedly from the flows characteristic of the subjects in the present study.

Wallace selected two male trades, automotive mechanic and construction electrician, and two female trades, senior stenographer and beautician, for study. He used age at the commencement of the program and years of training taken as variables and found that the teacher training programs were profitable under all of the given conditions. The returns for the two female vocations were highest, averaging in the 30% and 40% range. Automotive mechanics could expect returns of approximately 19%, and construction electricians of around 14%. When Wallace's returns based on years of training and age were matched with equivalent data for this study, an important fact emerged. The sizeable subsidies paid to vocational teacher training students in the first year of their program served to make profitable an investment in education that was otherwise very unprofitable. This indicated that a policy of providing free or low

tuition, subsistence allowances, and financial assistance in the forms of bursaries, grants, and scholarships could substantially alter the economic attractiveness of an educational program. Thus governments and social agencies have at their disposal potentially powerful incentives for channelling students into programs which may be costly or low-paying but which are desirable for meeting special or critical social needs. Whether such interference with or regulation of a free labour market is warranted must remain a value question that can be answered only in part by purely economic considerations.

Social Implications of the Findings

Throughout the chapter various implications respecting teacher education and the teacher labour market have been suggested by some of the findings. These implications are collated and summarized in this section in order to show how the information yielded by the study may be useful socially.

Minimum Certification Requirements

With the exception of vocational education teachers, the minimum period of training presently required for initial teacher certification in Alberta is three years. Therefore, the typical choice facing entrants into the general four-year Bachelor of Education program is to take either three

years or four years of training before teaching. The study showed that acquiring four years of training as the initial level of qualification was financially more attractive for both males and females. For males, the present values, at 8%, associated with a four-year program were more than double the present values of the three-year program for any length of payoff period. For example, the present values of the marginal lifetime earnings for male subjects under age twenty-five were \$9,647 for three years of training and \$20,127 for four years (see Table 12, subjects #1 and #11).

For female subjects, the present value differences favouring four years of training over three were also substantial as may be observed from Table 12 (subjects #6 to #10 compared with subjects #16 to #20). Again to give an example of these differences, the discounted marginal lifetime earnings for females under twenty-five years of age were \$36,000 for three years of training and \$46,535 for four years (subjects #6 and #16).

These observations would suggest that the Bachelor of Education degree, or its equivalent, could well be made the minimum prerequisite for teacher certification in Alberta. Certainly from the students' point of view such a policy would be financially rewarding. The gain to be made by completing an additional year of study above the minimum of three years was found to be so large that in

effect there existed little if any financial impediment to completing the degree before teaching, even if funds had to be borrowed for the purpose. Whether such a policy would be socially desired might be arguable, but the tenor of the times suggests that higher levels of teacher qualification are being advocated on many sides.

Raising Levels of Teacher Qualifications

Additional teacher education taken by subjects who already held some teacher training was shown to be profitable under all of the circumstances studied, provided that it was followed by from ten to fifteen years of teaching service. Knowing that additional training is profitable should provide a forceful argument to those agencies and segments of society that advocate that teachers with partial training should strive to improve their educational standing. Teachers themselves may be persuaded by the evidence to return to university, since they stand to gain both financially and educationally. If there is indeed a general social demand in Alberta for raising the level of qualification of the teacher labour force, then rate-of-return information such as reported in this study may be potentially useful in helping to achieve this objective.

Alberta Salary Schedules

Rate-of-return analysis may be useful as a means of evaluating the adequacy of existing average rates of salary

paid to Alberta teachers with differing qualifications. A more comprehensive comparison of teachers' salaries with salaries in other professions is made possible because variables such as educational costs, length of study period, and the shape of the earnings profile are taken into account. Comparison of cost-benefit relationships would be added to comparisons of pay levels, perhaps giving some additional insights into the problem of establishing rates of pay for teachers.

Rates of return may also be useful for evaluating the equity of salary rates for teachers in different training categories on the salary schedule. To illustrate, the study showed that acquiring a four-year degree or its equivalent was unequivocally the superior investment choice for teachers in Alberta. Three-year qualifications were, in relative terms, the least attractive level of training to hold. Do these results represent unintentional inequities built into the average salary structure in Alberta, or do they reflect deliberate social policy designed to encourage teachers to complete a degree rather than to settle for three years of training? Are Alberta pay scales comprised largely of administered prices or of true equilibrium prices established by supply-demand forces operating in the market for variously-trained teachers? These questions introduce complications into the use of rates of return for evaluating and establishing teacher pay schedules; but if it could be determined that

rate-of-return differences among sub-categories do indicate inequities, then future salary settlements might be modified to permit a comparably fairer rate of return to the teachers affected. On the other hand, if salary schedules reflect equilibrium prices in the teacher market, tampering with the existing pay relationships among teacher sub-categories would be unwarranted.

Subsidization of Education

Private rates of return may show that particular educational investment ventures are not profitable. A case in point is the low return in teaching for males in Alberta who decide to take education after age twenty-five or thirty. If the low private returns result from market imperfections, they may not reflect true demand or real social need. It is also possible that the social rate of return for a particular skill is relatively high, but certain contingent factors make the private rate of return low in comparison to alternative investment opportunities. The Wallace study which was reviewed earlier demonstrated that in such cases subsidies during the period of study provide an effective means of making economically attractive an educational program which has low private returns, but which at the same time is highly desirable socially. In marginal cases such as the type-OB' males in this study, there may be circumstances which make advisable the furnishing of sufficient subsidization,

perhaps by remission of fees or by bursaries, to tip the scales in favour of making the educational investment privately profitable.

Hansen (1967), Schultz (1967), and other writers have noted that there is enough historical evidence to show that subsidization policies such as tuition-free universities would create a substantially increased demand for and enrolment in higher education. If the subsidization is for a particular type of educational or skill-training program, then enrolments in this program may be predicted to rise relative to enrolments in unsubsidized programs. Thus subsidization of education is a potentially useful social means of creating an increased supply of wanted manpower.

The Importance of Knowledge in the Labour Market

Leibenstein (1965) in an article analysing the market for human skills emphasized that one of the major imperfections in this market is lack of information. Ignorance and uncertainty affect not only the supply or production of educated manpower, but the efficient utilization of the existing supply. Information that is produced by studies such as this one may be useful in facilitating equilibrium conditions in the labour market. Higher rates of return for teacher training compared to alternative educational investments can be interpreted to mean a relative scarcity of this

type of human skill. High school graduates equipped with the knowledge of comparative returns will tend to enter teaching if its returns are higher. On the other hand, low rates of return to teaching indicate relative surpluses of teachers and would serve as disincentives to students, diverting them to programs that are economically more attractive. In this manner, knowledge in the labour market operates to wipe out shortages and surpluses of teachers; and what is noteworthy, this equilibrating mechanism works through individual choice and not through the imposition of social policy or political decree.

Within the teacher labour market specifically, knowledge of returns to different levels of training can serve through the same self-equilibrating mechanism to produce a supply of teachers in the numbers and with the qualifications demanded. A higher investment return for higher qualifications will induce teachers with lower qualifications to take further training; it may even draw back into university and into the classroom ex-teachers who have quit the profession for other work. High returns may also influence teachers to stay in the profession. Low returns would have the opposite effects, inducing mobility of teachers to more lucrative jobs and hence to more efficient utilization of educated manpower.

Whatever imperfections may exist in the teacher labour market in Alberta, there is evidence that the market operates

in the manner described above. Longitudinal data on changes in qualifications held by teachers in Alberta gathered by Hanson (1969b, p. 62) supports the hypothesis that teachers respond to higher private returns for higher qualifications by raising their standards of formal education. Hanson's data showed that the percentage of Alberta teachers holding four or more years of training doubled during the period 1958 to 1968, going from 21.7% to 43.8%. At the same time the proportion of teachers holding one or two years of training declined by about one half. Although a part of these changes may be attributed to changes in certification requirements during the period, and perhaps to other factors as well, it is reasonable to assume that teachers implicitly responded to the more favourable cost-benefit relationships that prevailed at the degree level of training.

Knowledge derived from the treatment of education as human capital or as an investment activity can, therefore, be applied directly to the subject of teacher supply and teacher quality. Granted that certain important assumptions underlie this treatment, human capital is nevertheless a fruitful theoretical perspective which helps to give some understanding of the market for teachers with various levels of training. As well, it gives an understanding of the market for teachers relative to the market for other kinds of educated and skilled labour.

Efficient Allocation of Resources

Whether private or social rates of return can serve as guides to the efficient allocation of productive resources is an issue upon which economists are sharply divided. Certain economists like Solow (1963) and Schultz (1967), however, are convinced that from a planning point of view in the formation of capital and economic development, the central concept should be rate of return. Yet there are many analytical difficulties which beset capital theory; and the connections among economic growth, capital accumulation, and rate of return are far from clear (Schultz, 1967, p. 293). Pending further clarification of this issue, all that can be said for the moment is that investment analysis of the type undertaken here may provide useful guidelines as to the type of physical or human capital that should be produced. Thus if returns to teacher education are higher than the returns to arts and science education, relatively more university spaces should be created for education students than for arts and science students. Rate of return, however, does not indicate how many more spaces should be provided; it points the direction in which educational and related planning should move, but does not show how far it should move.

Perhaps the example given is too simplistic, for educational and economic planning problems are too complex to be resolved by simple investment analysis. In the argument, the consumption benefits of education have been ignored.

Investment analysis may show that rates of return for arts education are relatively low, but the demand for arts education as a consumption item may be high. Can consumption needs be ignored in favour of higher rates of return in the planning of educational facilities?

Probably not. Despite the complexity of the problem, investment analysis may furnish some of the vital guidelines needed to determine the best allocation of scarce educational resources.

CHAPTER VII

SUMMARY, CONCLUSIONS, AND IMPLICATIONS

The major purpose of the study was to make a cash flow analysis of private monetary returns to successively higher increments of teacher education for different types of subjects in the province of Alberta. Human capital theory provided the theoretical perspective for the study. Fundamental to the analysis was the computation of present values and internal rates of return associated with the investment choices possible for the different subject types. Whether or not the findings showed the investment choices to be economically attractive was the basis on which the results were interpreted.

The subjects of the study consisted of members or potential members of the Alberta teacher labour force. They varied with respect to sex, age, teacher education held, teaching experience, and number of years of teacher education sought. To capture the effects of different combinations of these variants upon the problem under study, the subjects were categorized into fifty different subject types.

For each subject type, the opportunity to attend a Faculty of Education in Alberta to acquire some given level of teacher qualification up to and including the Bachelor of Education degree was envisaged as a human capital investment problem that could be analysed to determine profitability.

Profitability was assessed in terms of internal rate of return and present value, and was affected by costs of investing in teacher education, by expected future earnings, and by the length of teaching service after training.

Marginal earnings streams, or net cash flows, for each subject type and for different lengths of payoff periods were derived by finding the differences between cash inflows and cash outflows. Cash outflows included the private academic costs of the teacher education program plus the entire earnings stream foregone by choosing to take the program. Inflows consisted of expected future earnings as estimated from an average teachers' salary scale constructed from data for all school systems in the province. No allowances were included in the inflows for income received from any source (such as summer work and scholarships) during the period of study.

All marginal earnings streams were discounted at 6%, 8%, and 12% to find the present value of the investment in teacher education. The 8% rate was set as the minimum acceptable return. An internal rate of return for each investment problem was also calculated. The present values and the internal rates of return constituted the major findings of the study.

The school year 1968-1969 was used as the base year for all cash flow data and as the focal date for cash flow analysis. Cost data were collected from the registrar's

office at the University of Alberta, and from an unpublished survey of university student income and expenditure undertaken by the Dominion Bureau of Statistics. Earnings data for teachers were provided by the Alberta Teachers' Association. Earnings profiles for Alberta high school graduates for 1968-1969 had to be estimated by up-dating 1961 Census of Canada earnings data. For this purpose indexes were constructed to reflect 1961 to 1968 wage and salary movements in Alberta for a cross-section of occupations. Earnings data were not adjusted for income tax, secular trend, morbidity, mortality, labour force participation rates, academic failure rates, and unemployment. However, an unemployment adjustment was implicit in the earnings profiles of high school graduates due to the nature of the Census data used. The omission of the various adjustments was judged as not having a significant effect on the findings, since past studies had shown the effects of these adjustments to be largely counter-balancing.

Certain assumptions fundamental to human capital and its measurement were considered to be fundamental also to the conceptualization of the study. These assumptions were as follows:

1. Physical and human capital are conceptually similar and may be analysed by similar techniques.
2. Cash flows in human capital analysis are adequately measured by direct monetary costs and returns.
3. Private marginal earnings arising out of improved

educational qualifications represent marginal productivity.

4. Earnings differentials among variously-educated groups are attributable entirely to differences in levels of education held.

5. Analysis of cross-section data provides accurate projections of cost-benefit patterns into the future.

Summary of Conclusions

A reservation rate of 8% was set as the minimum acceptable rate of return that had to be shown on a proposed investment in teacher education for it to be considered economically attractive. Using this criterion for interpreting the present value and rate-of-return findings for the different subject types, the following major conclusions were made.

Type-O Male Subjects

A three- or four-year program of teacher education proved to be financially attractive for Alberta males, provided they commenced their studies before age twenty-five. Teacher education was found to be unprofitable as an investment for males over twenty-five years of age, although the 25-34 year category might be considered marginal. Completing the degree was a much more attractive investment than completing only three years of study; in general, the profitability of either alternative increased as the length of the

payoff period increased. Both routes paid off after ten years of teaching. The investment analysis for type-0 males was not sensitive to the use of a reservation rate higher or lower than the basic 8%.

Type-0 Female Subjects

In contrast to type-0 males, teacher education for females was found to be economically attractive under all of the circumstances studied. All rates of return were relatively high, exceeding 20% in most cases, but declining with age. In present value terms, the four-year program was more attractive than the three-year, and both paid off in ten years in all cases. Payoff was attained more rapidly the younger the subject at the commencement of study. In general, the economic attractiveness of investment in teacher education by Alberta females was found to vary directly as the amount of training sought and length of payoff period, and inversely as age.

The difference in profitability of teacher training between men and women was accounted for mainly by lower opportunity costs for women and teacher wage parity between sexes.

Type-I, II, and III Subjects

For all three types of teacher subjects the attractiveness of investment in further teacher training varied directly as years of education sought, length of payoff

period, and experience held at commencement of studies. Completing the Bachelor of Education degree or the fourth year of study was found to be the most attractive alternative, and completing the third year the least attractive. All investment possibilities for type-I and type-II subjects proved to be profitable if followed by fifteen years of teaching, although for some cases profitability occurred sooner. All type-III investment problems showed profitability after ten years of teaching. Where earnings differentials between years of training were large, the choice of reservation rate was not critical to the analysis. Where earnings differentials were small, the choice of reservation rate and the length of payoff period became important determinants of profitability.

Effect of Teacher Education Held on Returns

The subjects who stood to gain most financially from further teacher education were those who already held the highest qualifications.

Break-Even Point

With the exception of some type-0 male cases, all subject types could expect their investments in teacher education to pay off within a reasonably short time. Some of the investments were found to pay off after only four or five years of teaching, and no investment required a longer payoff period than fifteen years to become profitable.

Comparisons with Other Studies

The private returns to a Bachelor of Education degree for males in Alberta were found to be the same as returns averaged by all degreed male teachers in Canada. However, these returns were slightly less than returns reported for Canadian males with a university degree. Alberta female graduates in teacher education earned higher private returns than were earned by Canadian male or female teachers, or by male university graduates in Canada. Returns to teaching degrees reported for male and female teachers in Quebec and Ontario were lower than average returns reported for Canada as a whole, and lower than returns computed in this study for Alberta degreed teachers.

Male candidates entering teaching in Alberta could expect to receive the same returns whether they chose to take the regular Bachelor of Education degree route, or a three-year Bachelor of Arts or Science degree followed by one year of teacher education.

In Alberta, the four-year Bachelor of Education degree was financially more attractive than a three-year Bachelor of Arts or a Bachelor of Science degree, but less attractive than a four-year Bachelor of Science in Engineering degree. Returns to three years of teacher education were much lower than the returns to a three-year Arts or Science degree.

Methodology

Both present values and rates of return showed a tendency to level off after a ten- to fifteen-year payoff period. The present value, however, was observed to be more sensitive to the entire length of the earnings stream, since it kept increasing (although by diminishing increments) after the internal rate of return became constant. In human capital studies utilizing cash flow analysis, if the flows for the first ten or fifteen years can be accurately forecast, significant shifts or errors can occur in the next decades without substantially altering the results. Little additional information is gained by projecting flows beyond twenty-five or thirty years.

The present value and internal rate of return do not always give the same ranking to an investment project. Therefore, the best strategy in cash flow analysis is to use both calculations. The present value will indicate which project maximizes returns, while the internal rate of return will show which project is the more efficient investment. The internal rate of return has the advantage of being easily comparable with returns found in other studies and with returns reported in business and industry.

Implications

The following implications are suggested by the findings made in the study:

1. Establishing the Bachelor of Education degree or its equivalent as the minimum level of qualification for initial teacher certification in Alberta would be financially advantageous to the student.

2. Social policies designed to increase the supply of teachers may be implemented through both raising the levels of teachers' salaries and reducing private educational investment costs through some form of subsidization.

3. The level of qualification of the teacher labour force may be raised through higher private rates of return. The evidence suggests that in the past Alberta teachers have responded to economic incentives in improving their qualifications.

4. Rate-of-return analysis may be useful as an additional criterion for establishing rates of salary for teachers.

5. The knowledge gained from rate-of-return studies, if widely disseminated, may facilitate the establishment of equilibrium conditions in the market place for educated manpower by the elimination of shortages and surpluses. Information on comparative private returns to higher education should be made available for the guidance of individuals in career decisions.

6. Whether or not rate-of-return studies can furnish policy guidelines for more efficient allocation of resources

remains a moot question among economists of education. Many would agree, however, that these studies do provide valuable information for educational planning.

Recommendations for Further Research

In the process of researching the central problem of the study, various related questions arose which deserve attention and which should form the subject of further research. Among these questions, the following are important:

- (1) What are the private monetary returns to occupations and professions which are reasonable alternatives to teaching?
- (2) What are the social returns to investment in teacher training and how do these returns compare with social returns to other forms of human capital?
- (3) What effects does income during the period of study, such as earnings from summer and part-time work, bursaries, and scholarships, have on rate of return and present value?
- (4) What effects do additional expenditures, such as the higher costs of living away from home, moving expenses, and income tax have on rate of return and present value?
- (5) What are the private and social maintenance costs of teacher education, how do these compare with other professions, and what effect have they on monetary returns?

There are other problems as well which may be identified from the set of assumptions which formed the basis of the study. For example, the assumption was made that subjects

respond to economic incentives. The nature of this response needs to be studied and measured not only with respect to teacher education but for other programs as well. Particularly important would be knowing what change in supply of manpower in specific occupations results from changes in rates of return or present value. The effect of differences or changes in private returns on labour mobility and on interregional migration (especially within the teaching profession) is also important and should be studied.

Implicit in human capital theory is the assumption that education should be one of the relevant variables in estimating the production function of firms. Applied to schools, this would mean that if the education of teachers is a significant input, there should be observable evidence that increased teacher qualifications result in increased educational productivity. This relationship has been largely assumed and requires empirical testing; an associated theoretical difficulty is, of course, adequately conceptualizing and measuring productivity in education.

The measurement of social returns to education is in need of much repair and forms a fertile field for theoretical development. Human capital theory to date has largely ignored the external costs and benefits of education. A better understanding of this dimension of the problem is needed.

Finally, cost-benefit studies may be usefully applied

to evaluate alternative routes to achieving the same educational goal. For example, a tradesman may be trained in several ways: through technical-vocational programs in high school, through formal programs in post-secondary institutions, and through apprenticeship or on-the-job training. Cost-benefit analysis may form a useful measure of the efficiency of each alternative. Teachers in Alberta may obtain an additional year of qualification through attendance at Summer Schools as an alternative to regular Winter Session attendance. The private and social benefits of these two alternative routes to higher training are worth measuring and comparing. In conclusion, there may be merit in applying cost-benefit analysis to evaluate the effectiveness of any program alternatives at any level of education.

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A P P E N D I X A

GLOSSARY OF TERMS

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Break-even point. In the study, the point in the marginal earnings stream where the cumulative discounted value changes sign from negative to positive. The break-even point indicates the number of years of teaching service which must follow the period of study in order for the human capital investment to become profitable.

Capital. All produced goods which are used as inputs for further production. Capital goods produce a flow of outputs, and hence, a flow of earnings or income over a future period of time.

Cash flows, inflows, outflows. Cash flow simply refers to the inflows or outflows of monies over time. An inflow is an income; an outflow is a cost. The net cash flow is equal to the inflows minus the outflows.

Cost of capital. The rate of return investors require in order to be attracted into investing funds into an enterprise. For example, the rate of return may be thought of as the rate of interest which governments and corporations pay on debt (bonds and debentures) or equity capital (shares).

Cross-sectional income and cost data. The existing pattern of costs and earnings at a point in time, or at the focal date.

Discount rate. The compound rate of interest used for finding the present value of a sum of money due in the

future.

Earnings. Income derived from wages and salaries. Earnings flows in the study do not include income from sources such as property and investment.

Earnings stream, or earnings profile. The year by year flow of earnings over a period of time.

Economic growth. An increase in a nation's capacity to produce goods and services coupled with an increase in the production of these goods and services. Usually economic growth is measured by the annual rate of increase in a nation's Gross National Product, adjusted for price changes.

Elasticity of teacher supply. An index derived to measure the responsiveness of the supply of teachers to a change in the salary paid to teachers. It is found by dividing the percentage change in real salaries by the percentage change in supply. If the index is greater than 1, the supply is elastic indicating that a change in teachers' salaries induces a more than proportional change in teacher supply.

Equation of value. In the study, an equation which sets the value of the sum of outflows as equal to the value of the sum of inflows at the focal date.

External benefits or economies. Returns or economic benefits which accrue to second parties and beyond from the possession of a good or from the activity undertaken by others. For example, if a skilled individual is placed to

work with a group of unskilled workers, the unit productivity of each unskilled worker may be increased by his presence. The increased benefits accrue to society and are therefore external to the skilled individual.

External costs or diseconomies. The harmful effects or costs caused to others by the economic activity of someone else. For example, the establishment of an air-polluting factory in a residential neighbourhood lowers property values.

Factors of production. See "Resources".

Factor market. The market in which the factors of production are exchanged for income at price levels established by the prevailing market conditions. The exchange of one's labour for wages takes place in the factor market.

Focal date. The common point in time established for the valuation of past or future cash flows. In the study, the focal date and the investment decision point is the 1968-1969 school year.

Human capital. In the study, human capital refers to education embodied in the labour force or in the teaching force. In general terms, it refers to the investment in the education, skills, health, and welfare of a nation's population.

Inflows. See "Cash flows".

Internal rate of return. The discount rate which makes the sum of the outflows equal to the sum of the inflows at the focal date. Alternatively, it may be defined as the discount rate which makes the present value of the net cash

flows or the marginal earnings stream equal zero. It indicates the internal rate of interest an investor earns on his investment if he recovers his capital in a stipulated number of time intervals.

Iteration. The process of solving the equation of value for the internal rate of return by successive substitution of trial discount rates.

Marginal. In economics, marginal means extra or additional. Thus marginal costs mean the extra costs incurred from choosing to do something.

Marginal earnings stream, or net earnings stream, or net cash flow. These terms are synonymous in the study and refer to the extra earnings that are added to a subject's earnings profile as a result of going from a lower to a higher level of teacher qualification.

Net cash flow, or net earnings stream. See "Marginal earnings stream".

National income. National income is a statistical statement of national output or receipts. In Canadian national accounts, the net national income consists of the total receipts of wages, salaries, interest, rent, corporation profits, and income from unincorporated business. When indirect taxes and depreciation on capital are added to this total, the figure becomes the Gross National Product which is the value of the nation's total output of final goods and services at market prices.

Opportunity cost. The cost of anything in terms of the most desirable alternative, or gain, foregone. In the study, the opportunity cost of going to university is taken as the income foregone during the years of study plus the income profile foregone by entering the labour market at a higher level of educational qualification. Thus the total cost of teaching at a higher level of qualification is the stream of earnings foregone from teaching at a lower level plus the academic costs incurred by taking additional teacher training. By incorporating the opportunity cost concept into the cost flows, the marginal earnings stream is directly calculable between any two levels of teacher qualification.

Outflows. See "Cash flows",

Period. The period for cash flow analysis in the study is of one-year's duration.

Present value. The present time value of a sum of money receivable at some time in the future. The present value of an income receivable ten years hence is found by discounting the income to the present using a compound interest rate. From the point of view of the present, the present value of the income is equivalent to the sum of money that would have to be invested now at the given rate of compound interest in order to yield the required income in ten years.

Private costs and returns. Costs incurred or earnings gained directly by the individual.

Private rate of return. The internal rate of return on an investment which accrues directly to the individual. Only private costs and returns are included in the cash flows for computing the private rate of return.

Psychic returns to education. The intangible, non-material, spiritual, or psychological rewards which a person continues to enjoy as a result of his education (such as the appreciation of literature, being a good citizen rather than a criminal, etc.). These returns or benefits are generally not measurable in monetary terms.

Real income. The purchasing power of the income of an individual or a nation. Real income is computed by adjusting money income to changes in consumer prices. Thus if the price index rises by the same amount as money incomes, real income remains unchanged, for consumers can purchase neither more nor less with their money incomes.

Real, or constant, dollar. A series of dollar values, such as Gross National Product, personal income, sales or profits from which the effect of changes in purchasing power of the dollar has been removed. The resulting series is in real terms and thus indirectly measures physical volume.

Reservation rate. The minimum acceptable rate of interest, established in the study as 8%.

Resources, or factors of production.

The three major productive factors are property resources, including land; capital; and human resources, or labour. Land includes all natural resources Capital includes all man-made aids to production such as buildings, machinery, and transportation facilities. Labour includes all human physical and mental talents employed in producing goods. Entrepreneurial ability is often considered a fourth factor of production; it includes the organization of the other three factors for productive purposes, innovation, and the bearing of the risks of the business operation. Since all economic resources are relatively scarce and limited in supply, they all receive some type of income for their services. Income for the use of land is rent, income for use of capital is interest, and the income of labour is wages. Income for entrepreneurial ability is profits (Greenwald, 1965, pp. 191-192).

Secular trend. A statistical term denoting the regular, long term movement of a series of economic data, such as the Gross National Product.

Social costs. The value of total resources which society allocates to an enterprise. The social costs of teacher education includes the value of all resources devoted to the education of teachers (cost of buildings, professors' salaries, debt charges, land, equipment, etc.).

Social benefits. The value of goods and services produced by an individual or firm which adds to the national product or national income of a country.

Social rate of return. The internal rate of return in which social costs and social benefits determine the cash flows; thus, it is the rate of return which society realizes on an investment.

Subject. As defined specifically for the study, subject means any potential or current member of the Alberta teacher labour force who is qualified to attend a university in Alberta for the purpose of acquiring some years of teacher education up to and including the Bachelor of Education degree. The subjects of the study are divided into fifty types on the basis of sex, experience or age, years of teacher education held, and years of teacher education sought.

A P P E N D I X B

INDEXES OF MEAN WAGE AND SALARY RATE INCREASES
FOR MALES AND FEMALES IN ALBERTA
FOR THE PERIOD 1961-68

TABLE A

INDEXES OF MEAN WAGE AND SALARY RATE INCREASES FOR MALES
IN SELECTED OCCUPATIONS IN ALBERTA FOR THE PERIOD
1961-1968
(INDEX FOR 1961 = 100)

| Occupation | Mean monthly rates | | 1968 index (males) |
|---|--------------------|----------------|--------------------------|
| | Males, 1961 | Males, 1968 | |
| 1. Junior clerk | \$ 242 | \$ 305 | 126.03 |
| 2. Intermediate clerk | 359 | 449 | 125.07 |
| 3. Senior clerk | 449 | 538 | 119.82 |
| 4. Pay-roll clerk | 351 | 439 | 125.07 |
| 5. Bookkeeper | 392 | 525 | 133.93 |
| 6. Calculating machine, comptometer operator | 280 | 315 | 112.50 |
| 7. Bookkeeping machine operator | 285 | 367 | 128.77 |
| 8. Tabulating machine operator | 357 | 472 | 132.21 |
| 9. Labourer | 321 | 417 | 129.91 |
| 10. Labour foreman | 457 | 564 | 123.41 |
| 11. Light truck driver | 287 | 409 | 147.12 |
| 12. Heavy truck driver | 316 | 494 | 156.33 |
| 13. Heavy equipment operator | 349 | 514 | 147.28 |
| 14. Tradesman's helper | 298 | 403 | 135.23 |
| 15. Janitor | 267 | 370 | 138.58 |
| 16. Carpenter | 362 | 546 | 150.83 |
| 17. Hardgoods salesman | 297 | 380 | 127.95 |

TABLE A (continued)

| Occupation | Mean monthly rates | | 1968 index (males) |
|---|--------------------|----------------|--------------------------|
| | Males, 1961 | Males, 1968 | |
| 18. Butcher | \$ 377 | \$ 577 | 147.75 |
| 19. Shoe salesman | 311 | 389 | 125.08 |
| 20. Men's and boys' furnishing salesman | 285 | 369 | 129.47 |
| 21. Men's and boys' wear salesman | 309 | 393 | 127.18 |
| 22. Tailor | 300 | 433 | 144.33 |
| 23. Warehouse order desk clerk | 299 | 410 | 137.12 |
| 24. Warehouse counterman | 286 | 392 | 137.06 |
| 25. Warehouse checker | 296 | 430 | 145.27 |
| 26. Warehouse packer | 286 | 337 | 117.83 |
| 27. Warehouse shipping clerk | 298 | 397 | 133.22 |
| 28. Warehouseman | 275 | 389 | 141.45 |
| 29. Elevator operator | 280 | 345 | 123.21 |
| Mean of all indexes (males) = | | | 133.41 |

Source: Alberta Bureau of Statistics. *Alberta Salary and Wage Rate Survey*, May, 1961 and August, 1968.

TABLE B

INDEXES OF MEAN WAGE AND SALARY RATE INCREASES FOR
FEMALES IN SELECTED OCCUPATIONS IN ALBERTA FOR THE
PERIOD 1961-1968
(INDEX FOR 1961 = 100)

| Occupation | Mean monthly rate | | 1968 index (females) |
|--|-------------------|------------------|----------------------------|
| | Females, 1961 | Females, 1968 | |
| 1. Junior clerk | \$ 200 | \$ 264 | 132.00 |
| 2. Intermediate clerk | 249 | 338 | 135.74 |
| 3. Senior clerk | 294 | 376 | 127.89 |
| 4. Pay-roll clerk | 268 | 354 | 132.09 |
| 5. Junior clerk typist | 203 | 266 | 131.03 |
| 6. Senior clerk typist | 249 | 302 | 121.29 |
| 7. Junior stenographer | 229 | 302 | 131.88 |
| 8. Stenographer | 261 | 347 | 132.95 |
| 9. Secretary | 313 | 399 | 127.48 |
| 10. Bookkeeper | 298 | 375 | 125.84 |
| 11. Telephone operator | 222 | 297 | 133.78 |
| 12. Calculating machine, comptometer operator | 239 | 323 | 135.15 |
| 13. Bookkeeping machine operator | 221 | 297 | 134.39 |
| 14. Billing machine operator | 223 | 318 | 142.60 |
| 15. Key punch operator | 261 | 338 | 129.50 |
| 16. Tabulating machine operator | 357 | 438 | 122.69 |

TABLE B (continued)

| Occupation | Mean monthly rates | | 1968 index (females) |
|---|--------------------|------------------|----------------------------|
| | Females, 1961 | Females, 1968 | |
| 17. Nurse aide | \$ 207 | \$ 314 | 151.69 |
| 18. Janitor | 163 | 272 | 166.87 |
| 19. Sales clerk smallwares | 187 | 275 | 147.06 |
| 20. Hardgoods sales- woman | 217 | 289 | 133.18 |
| 21. Grocery cashier | 251 | 387 | 154.18 |
| 22. Saleswoman fashion accessories | 202 | 265 | 131.19 |
| 23. Womenswear sales- person | 212 | 276 | 130.19 |
| 24. Corset saleswoman | 225 | 292 | 129.78 |
| 25. Shoe saleswoman | 236 | 296 | 125.42 |
| 26. Women's and girls' furnishing sales- person | 213 | 280 | 131.46 |
| 27. Home furnishings salesperson | 221 | 335 | 151.58 |
| 28. Tailoress | 199 | 288 | 144.72 |
| 29. Warehouse order desk clerk | 229 | 290 | 126.64 |
| 30. Warehouse packer | 222 | 293 | 131.98 |
| Mean of all indexes (females) = | | | 131.17 |

Source: Alberta Bureau of Statistics. *Alberta Salary and Wage Rate Survey*, May, 1961 and August, 1968.

TABLE C

PERCENTAGE INCREASES IN MEAN WAGE AND SALARY RATES IN
ALBERTA AS CALCULATED FROM VARIOUS DATA SOURCES

| Salary and wage rate data for: ^a | Seven- year period | Percentage increases | | |
|---|--------------------------|----------------------|---------|--------|
| | | Males | Females | Total |
| 1. Selected occupations | 1961-68 | 33.41% | 31.17% | 32.28% |
| 2. Industry (salaried employees) | 1961-68 | -- | -- | 34.15 |
| 3. Teaching (standard certificate) | 1961-68 | -- | -- | 30.35 |
| 4. Teaching (professional certificate) | 1961-68 | -- | -- | 29.63 |
| 5. Manufacturing (clerical employees) | 1960-67 | 35.87 | 34.14 | 33.91 |
| 6. Manufacturing (salaried employees) | 1960-67 | 30.14 | 33.87 | -- |
| 7. Alberta farm income | 1960-67 | -- | -- | 33.91 |
| 8. Average annual income of all taxable Albertans | 1960-67 | -- | -- | 29.38 |

^aNotes on data sources:

1. Tables A and B, Appendix
2. Dominion Bureau of Statistics, *Employment and Payrolls, July, 1961*. Catalogue No. 72-002 (Ottawa: Queen's Printer, 1961), Table I; Dominion Bureau of Statistics, *Employment and Weekly Wages and Salaries, August, 1969*. Catalogue No. 72-002 (Ottawa: Queen's Printer, October, 1969), Table I.
3. Alberta Department of Education, *Annual Report, 1961 and 1968* (Edmonton: Queen's Printer).

TABLE C (continued)

4. *Ibid.*
5. Dominion Bureau of Statistics, *Earnings and Hours of Work in Manufacturing, 1960*. Catalogue No. 72-204 (Ottawa: Queen's Printer, June, 1962), Tables A and F; Dominion Bureau of Statistics, *Earnings and Hours of Work in Manufacturing, 1967*. Catalogue No. 72-204 (Ottawa: Queen's Printer, August, 1969), Table B and Table 8.
6. *Ibid.*
7. Unpublished data obtained from the Alberta Bureau of Statistics, November, 1969.
8. *Ibid.*

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